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October 22, 2015

Mr. Nikia Greene
US EPA Region VIII, Montana Office
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Helena, Montana 59626

Mr. Daryl Reed, State Project Officer
Montana Department of Environmental Quality
State of Montana
1100 North Last Chance Gulch
P.O. Box 200901
Helena, Montana 59620-0901

Re: Final BMFOU Berkeley Pit Slope Stability Evaluation, STRATA Report

Dear Mr. Greene and Mr. Reed:

The Settling Defendants (Atlantic Richfield Company and the MR Group, as defined in the Consent Decree) respectfully submit the **Final BMFOU Berkeley Pit Slope Stability Evaluation** prepared by **STRATA**. The Final version addresses Agency comments received on November 6, 2014. This advance electronic copy will be followed by the hardcopy via regular mail.

Submission of this report does not constitute a statement by AR or MR concerning responsibility between them for any identified tasks or a statement by AR or MR that any specific tasks is required to comply with any existing agreement.

Please contact us if you would like to schedule a meeting to discuss the final report.

On behalf of the Settling Defendants,

Mark Thompson
Manager of Environmental Affairs
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Comment 1:

Please reference the Critical Water Level (CWL) of 5410' (USGS datum) to the correct compliance point (currently at the Pilot Butte Mine) throughout the report. Additionally, at the current compliance point, the water level in the Pilot Butte Mine is approximately 24 feet above the surface level of the pit. This too should be noted in the report in appropriate places.

Response:

The CWL of 5410' (USGS datum) at the Pilot Butte Mine is the current compliance point and will be referenced in the report as requested.

Also, additional text has been added to the report that describes the distinction between the CWL compliance point elevation and the surface elevation of the Berkeley Pit Lake. This elevation difference provides a buffer between the pit water level and the compliance point water level. The revised text provides additional context to understand the potential impacts of pit slope slumping on the CWL. STRATA utilized a maximum pit water elevation of 5,410' (USGS datum) for the BMFOU Berkeley Pit Slope Stability Evaluation ("Evaluation") understanding that this water elevation may never be reached in the pit. Consequently, the results of the Evaluation should be considered conservative.

Comment 2:

The report was lacking in stormwater routing information. For example, catchment area, hydraulic structures ratings and erosion counter-measures are not fully described. These factors are an important part of the analysis because of the potential for erosion due to large stormwater inflows. If stormwater is not being channelized and discharged in a controlled manner – i.e., if significant runoff is not being discharged by overland flow into the pit – it is apparent from the report that continued erosion will occur in the upper stratums of the slopes. STRATA alludes to re-routing stormwater from discharge at the Neversweat section in recommendations for Task 1. This recommendation is prudent and investigating the potential for routing stormwater away from unstable sections should be emphasized in the revised report.

Response:

Reference in the report to storm water induced slope instability is limited to the outlet pipe where Butte Priority Soils Operable Unit (BPSOU) storm water is diverted to the Berkeley Pit in the Neversweat Sector. An evaluation of storm water routing pursuant to BPSOU requirements was not included as part of the scope for the Evaluation. In earlier

BPSOU orders, EPA directed that runoff from portions of the BPSOU be diverted to the Berkeley Pit in a controlled manner. According to the **Explanation of Significant Differences, Appendix A** to the **BMFOU Consent Decree,** this storm water only becomes a BMFOU responsibility "after it enters the Pit**.**" For these reasons, issues related to re-routing of storm water should not be considered as part of the Evaluation or report.

Comment 3:

Please provide recommendations for addressing continued erosion and undercutting by surface water (i.e. waves on the pit) and surface water runoff in the revised report.

Response:

Continued erosion and undercutting of the Bird Watch Dump was noted in the report. Currently there are inspections along the crest of the dump.

Dump erosion from wave action does not a have significant influence on <u>major</u> slope instability nor does it pose a risk of significant displacement volume in the Berkeley Pit. There are no stabilization efforts that can be implemented to reduce erosion from wave action on the Bird Watch Dump.

The scope of work for this evaluation did not include providing recommendations for mitigating activities.

Comment 4:

The report does not address slope stability analyses in sufficient depth regarding seismic, loading conditions. The seismic and post-seismic response such as the liquefaction conditions of the slopes is an important topic to discuss, considering the nature of the area and community concerns. The saturation of the alluvial layers and subsequent potential liquefaction constitutes slope instability. Also, the report mentions (on page 3) "over 30 million cubic yards of fill [that] are stockpiled in the eastern part of the Northwest Wall and continuing into the Colusa and Leonard Sectors" that are above the CWL and thus not included in Table 1 with a Potential Slope Failure Volume. But some of this fill rests on alluvium and thus there is a potential for slope failures due to earthquakes. Please add discussion of seismic activity and resulting conditions in the report.

Response:

The Final Work Plan for the BMFOU Berkeley Pit Slope Stability Evaluation Section 4.1.3 limited the slope stability analysis to identification of potential failure masses that may occur due to rising lake level. The scope of work never contemplated a multi-variant analysis of rising water and seismic loading.

However, in the revised report we have included an estimate of material susceptible to seismically induced failure and displacement below the CWL and the resulting change in pit water level.

The comment that the over 30 million cubic yards of fill that are stockpiled in the eastern part of the Northwest Wall and continuing into the Colusa and Leonard Sectors is on alluvium is inaccurate. None of this fill rests on alluvium and even more specifically, none of the fill material rests on saturated alluvium that would be susceptible to liquefaction under seismic loading.

Comment 5:

The Yankee Doodle Tailings Impoundment (YDTI) Failure Mode Analysis (Knight Piesold) discussed the Dam Breach Assessment presented in the Emergency Action Plan by MR in 2011. This analysis demonstrated that the consequence of a hypothetical impoundment failure would be mitigated by full containment of breach materials within the Berkeley Pit situated immediately downstream of the YDTI. Please add a discussion and recommendations regarding the impacts of the additional volume of material from YDTI, as well and the subsequent water displacement in the Berkeley Pit.

Response:

MR is required to prepare an Emergency Action Plan (EAP) describing the consequence of a hypothetical dam breach of the YDTI. In this case, the EAP describes a dam failure resulting from overtopping the embankment with floodwater and the resulting flow slide that would be contained by the Berkeley Pit. However, this portion of the EAP does not address the likelihood of the event.

MR designs and constructs the YDTI to contain the Maximum Probable Flood (PMF) event and still retain a minimum of 5-feet of freeboard on the embankment. The PMF includes a rain event of 14.4 inches of precipitation in 24-hours applied over the entire YDTI catchment area and on top of the 1 in 10-year snow pack and the catastrophic breach of two up-gradient municipal reservoirs.

Further, MR designs and constructs the YDTI to withstand the Maximum Credible Earthquake (MCE), which is equivalent to a magnitude 6.5 earthquake occurring directly under the embankment. The ground acceleration resulting from this event far exceeds the 1 in 10,000 year seismic event.

Given the extreme nature of the design criteria for YDTI and the exceptionally low likelihood of the events occurring during the operational life of the impoundment (stability and water storage capacity increase post-closure), it would appear inappropriate to discuss such unlikely events in the context of this evaluation.

Comment 6:

The first paragraph of the General Slope Stability Conditions section (page 3) states that the Bird Watch Dump was stabilized by placing large buttress fills at the slope face. However, the large tension cracks on the surface of the dump seem to indicate there is a potential for a slope failure along that existing plane of weakness. Please include a discussion of the Bird Watch Dump. Also, the Bird Watch Dump and associated slope material should be in included in the Potential Slope Failure Volumes in Table 1.

Response:

By mid1998 the rising pit lake had fully saturated the toe of the Bird Watch Dump and had a destabilizing effect. Uncontrolled progressive movement was observed at that time. In response, to stabilize the dump, the top of the dump was bulldozed off to buttress the toe of the dump. This effort stabilized the dump at that time.

Currently, the pit lake, itself, buttresses the saturated dump and the geometry is such that rising waters tend to increase the overall FOS associated with models of a massive, deep seated, dump failure. Ongoing wave action, however, under cuts portions of the dump slope and, from time to time, minor peal like sloughs occur that further buttress the underwater toe of the dump. Cracks that formed when the dump was initially destabilized by rising waters, and now clearly visible on the upper dump surface, continue to exhibit slow progressive movement. Slow displacement of the outer portion of the dump is ongoing at a rate of less than 0.6 inch per month. The dump is slowly moving to assume a stable angle of repose in response to gravity and ongoing weathering processes. Under static conditions a massive failure that would significantly impact the pit lake is not anticipated, and since the rising water level is increasing the stability, this dump was not included in the table identifying potential slope failure volumes affected by pit water level rise.

Comment 7:

Please provide documentation of how the Potential Slope Failure Volumes in Table 1 were calculated.

Response:

Text has been added to the evaluation to address this comment.

Comment 8:

Montana Resources (MR) continues to monitor and implement the groundwater pumping program from the three dewatering wells to improve slope stability, and continues to monitor four inclinometers, six extensometers and one TDR (information contained in the quarterly progress reports under "information about MR operations"). EPA and DEQ agree with the recommendations to continue these efforts. Furthermore, please provide MR's current monitoring schedule and results summarized as part of the quarterly progress reports.

Response:

These data will continue to be provided in the Quarterly Progress Reports. The monitoring schedule and results were presented in the 2014 Q4 Progress Report and will be included in subsequent reports as requested.

While slope stability monitoring and groundwater pumping is ongoing, the scope of work for this evaluation was not intended to include recommendations for monitoring or mitigating activities; therefore, those recommendations have been removed from the report.

Comment 9:

Please be consistent throughout the document when using the term "leach cap" opposed to "leaching cap".

Response:

The Final Report will be changed to be consistent and use the accepted description as "leached cap" as it refers to bedrock that has had the sulfide mineralization "leached" out and typically overlays the sulfide rock mass.

Comment 10:

Please review Table 2 for inconsistencies. For example, the grain size classifications and soil classifications at depths below 220 feet also suggest sediments rather than bedrock. Please correct the inconsistencies in Table 2.

Response:

Table 2 has been modified and text has been added to the evaluation to address this comment.

Geotechnical Tasks 1, 2, and 3
BMFOU Berkeley Pit Slope Stability Evaluation, Revised
Butte, Montana

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Butte, Montana

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August 13, 2014

Revised October 22, 2015

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BMFOU Berkeley Pit Slope Stability Evaluation, Revised
Butte, Montana

EXECUTIVE SUMMARY

Strata, A Professional Services Corporation (STRATA), has completed the scope of geotechnical services for the “Butte Mine Flooding Operable Unit (BMFOU): Berkeley Pit Slope Stability Evaluation” as authorized March 5, 2014, by Montana Resources LLP (MR) and Atlantic Richfield Company (AR). Task 1 focused on a general review of slope stability conditions around the entire Berkeley Pit. Rising pit water level is expected to have the greatest influence on potential slope instability in the extreme eastern part of the Berkeley Pit where the thickest sequence of *insitu* alluvium and overlying fill occurs in the Southeast Corner, Pittsmont, and Northeast Corner Sectors, and, to a lesser extent, the Concentrator Sector. The Neversweat Sector (along the southwest pit wall) contains other potential instability areas of mine backfill not influenced by pit water levels. Assuming a “worst-case scenario” where all these potential slope instability areas slide into the pit (under static or seismic conditions, or both), an estimated volume of 1.86 million cubic yards of slide material would cause a cumulative rise of approximately 3.2 feet in the pit water level (based on the current water elevation), which amounts to about 4 months’ worth of typical groundwater inflow (thus decreasing the time by 123 days to reach critical water level of 5,410 feet[1], referencing the USGS NGVD29 elevation datum).

Task 2 focused on sampling and testing subsurface materials in the Pittsmont Sector, then conducting an updated slope stability analysis in this area. Based on these recent laboratory testing results, estimated strength of the mine backfill was changed slightly, and the lower alluvium was shown to be less clayey (so its strength was increased slightly from that used in previous studies). Also, a volcanic flow unit approximately 70-feet thick was observed within the alluvium unit in the northern portion of the Pittsmont Sector, which tends to improve stability of potential deep-seated failure paths here. Furthermore, static groundwater levels here (hole PZF14-1A) are lower by 80 feet compared to that measured in the central Pittsmont Sector (Hole PZF13-1). As a result of these conditions in the northern area, slope instabilities here are less likely than in the central area, where recent slope stability modeling indicates marginal stability with computed FOS (factor of safety) values slightly greater than 1 (similar to the results from previous studies). MR has an operational plan to continue monitoring groundwater levels and potential ground displacement in this area. The updated slope stability modeling indicates that slope instability in the central Pittsmont area likely does not increase (and may actually decrease) after pit water level rises above 5,350 feet (expected in 2018-19).

Task 3 included drilling an oriented-core hole in the Concentrator Sector to evaluate subsurface conditions and study the potential of deep-seated slope failures through the bedrock leached cap. Previous slope stability studies here indicated the primary mode of possible slope failures was through the overlying fill and alluvium units, which are much thinner here than in the

[1] The BMFOU Consent Decree (CD) requires the Settling Defendants maintain the water level in the bedrock aquifer below the critical water level (CWL) as measured at 15 separate compliance points. Currently, the highest compliance-point water level in the bedrock aquifer is at the Pilot Butte mine shaft and is 24 feet above the water level in the Berkeley Pit. Therefore, it is anticipated that a compliance point other than the actual pit water elevation will trigger an action level far before the pit water level reaches the 5,410-ft level. However, in this report, pit water levels ranging from the current level to the hypothetical maximum water level (5,410 feet) were analyzed to ensure that this worst-case condition was considered.

Pittsmont Sector (alluvium thickness 120 feet compared to 350 feet). Fracture orientation logging in the core hole showed that most fractures in the leached cap and underlying quartz monzonite are favorably oriented from a slope stability standpoint, with only 2 minor fracture sets in the leached cap dipping northerly into the pit. Updated slope stability modeling indicates that potential deep-seated failure paths in the leached cap that may follow or step along these fracture sets are only slightly less stable than shallower paths comprising the alluvium only. Therefore, although deeper slope failure paths are possible in the Concentrator Sector they apparently do not pose significantly greater instability than potential alluvium failures previously studied.

TASK 1: REVIEW OF SLOPE STABILITY AROUND THE BERKELEY PIT

Geotechnical work associated with an overall review of slope stability in defined Berkeley Pit Sectors around the pit is the focus of this section. Pursuant to the “Work Plan” authorized by Montana Resources LLP (MR) and Atlantic Richfield Company (AR) on March 5, 2014, STRATA completed the following scope of services for Task 1:

1) Met with MR personnel to identify and review available sources of historical and geologic information. For example, one of the key sources likely was the 1978 PAH, Inc., report entitled "Berkeley Pit Slope Design." MR provided representative cross-sections that define current pit slope geometry and identify areas with significant amounts of mine backfill comprising upper portions of the slope.
2) Identified pit-slope sectors that have fairly unique geologic and geometric characteristics, and conducted a limited slope stability review of each sector. Based on pit geometry and geology, STRATA retained the original pit margin sector designations from the 1970’s, which comprised 8 sectors (Figure 1). However, STRATA subdivided the original Southeast Corner Sector into 2 sectors as follows: “Southeast Corner” in the western portion and including a small eastern portion of the original Concentrator Sector, and “Pittsmont” in the eastern portion and wrapping around along the eastern margin of the Berkeley Pit (Figure 1A).
3) Conducted limited slope stability analysis relying on available information (i.e., no current field work nor testing). Identified potential failures that may occur due to rising pit water level.
4) Estimated volumes of those potential failure masses and itemized them by pit-slope sector.
5) Prepared a draft letter to MR and AR summarizing STRATA’s findings and opinions regarding geotechnical work needed to more thoroughly characterize or model future slope stability as pit water level rises. STRATA incorporated review comments and edits in the draft letter, and then converted it into this current report section for Task 1.

Site Visit

STRATA’s Stan Miller, Senior Engineer, visited several areas of the Berkeley Pit during the period March 20-24, 2014. The visits focused on those areas containing significant volumes of mine fill resting along the margins of the pit slopes, specifically the Bird Watch Dump (Concentrator Sector), Pittsmont Dump (Southeast Corner and Pittsmont Sectors), and the fill site in the

Neversweat Sector (refer to Task 1 Appendix, Figure 1). The Neversweat Sector had experienced minor flooding and erosion, as well as some debris-flow activity, during a heavy precipitation event two weeks prior (see Task 1 Appendix, Figure 2, and Photographs 1 and 2). At the stormwater outlet, significant gulley erosion and related localized debris flows have produced a deep channel in the fill, which has over-steepened the fill slopes and undercut them near the fill toe at about elevation 5,423 feet (i.e., 5,480 feet, Anaconda elevation datum). As a result, a section of the fill slope spanning from 100 feet north of the outlet to 500 feet southeast of the outlet has experienced some movement, as evidenced by a series of fresh ground-surface tension cracks (refer to Figures 2 and 3, and Photograph 3). STRATA did not observe any other areas around the pit where stormwater erosion was over-steepening fill areas and potentially causing reduced slope stability.

Other large dumps along the margins of the pit slopes (refer to Figure 1) are located in the southern and eastern portions of the pit, and are shown in Photograph 4 with the Pittsmont Dump in the center of the photograph and the Bird Watch dump on the right side. The surface expression from the February 8, 2013, rotational slump is shown as a bowl-shaped depression at the south end (right side) of the Pittsmont Dump. Site reconnaissance of the Pittsmont and Bird Watch Dumps revealed no new tension cracking or other signs of instability. The latest tension-crack development activity noted by MR personnel in the Pittsmont area was April, 2013.

General Slope Stability Conditions

Based on recent site observations, historical geologic information provided by MR, and geotechnical information in the 1978 PAH report, STRATA characterized Berkeley Pit slope stability conditions into three general categories, as described below in Table 1. Based on MR personnel accounts, slope failures impacting the Berkeley Pit from the 1970's to 1990's were "stabilized" by either mining them out or, in the case of the Bird Watch Dump, by placing large buttress fills at the slope face. Though slope stability generally depends on a variety of factors (e.g., slope geometry, material properties, groundwater conditions) and some slope areas in the Berkeley Pit are inherently unstable, it is STRATA's opinion that only those sectors containing fill material or native *insitu* alluvium at elevations in the pit walls that coincide with the pit water elevation are the areas most likely to be affected by slope instability as pit water level rises.

As shown in Table 1, the primary areas of concern in regard to future slope instability as pit water level rises are in the south and east portions of the Berkeley Pit. Although over 30 million cubic yards of fill are stockpiled in the eastern part of the Northwest Wall and continuing into the Colusa and Leonard Sectors, all of this fill is located on bedrock and above elevation 5,543 feet (i.e., 5,600 feet per Anaconda elevation datum), and will not be impacted by critical pit water level defined at

5,410 feet. Refer to the Alignments (cross-sections) presented in Attachment 1 that correspond to Figure 1 (Task 1 Appendix) and show the mine-slope and fill topography. Likewise, the base of the fill deposit in the Neversweat Sector is located above critical pit water level and will not be affected by it. However, continued erosion and undercutting of this fill slope due to extreme stormwater runoff events may lead to progressive peeling and shallow sloughing here.

Potential slope failure volumes estimated in Table 1 are based on the assumption of rotational slough failure modes with approximate shapes tied to existing tension crack locations and experience with previous similar slope failures in fill or alluvium materials at the Berkeley Pit. STRATA assumed such rotational failures would occur along the entire length of each sector, and calculated the estimated volumes using available cross-sections. These should be considered typical volumes that may result under static or seismic conditions (or both); even if some such failures occur, it is STRATA's opinion that it is unlikely that all of them will occur as pit water level rises and is maintained at the prescribed critical level.

Table 1. Summary of General Slope Stability Conditions, Berkeley Pit

General Geologic Conditions	Sector	Approx. Elevation at Base of Fill (ft)	Approx. Elev. at Base of Alluvium (ft)	Potential Slope Failure Volume[1] (cu.yd.)
Primarily rock with minor amounts of fill or *insitu* alluvium	Northwest Wall	5,900	N.A.	None
	Southwest Wall	5,570 (Sec 32800) 5,450 (Sec 33800)	N.A.	None
Primarily rock with significant amounts of fill located above pit water level	Neversweat	5,480	N.A.	312,400[2]
	Colusa	5,705	N.A.	None
	Leonard	5,600	N.A.	None
Rock overlain by *insitu* alluvium and/or fill	Concentrator	5,450	5,430	668,400[3]
	Southeast Corner	5,400	5,240	208,300
	Pittsmont	5,380	5,200	511,100
	Northeast Corner	5,320	5,280	163,700
			Estimated Total Volume	*1,863,900*

[1]Estimate is based on assumption of shallow to mid-depth rotational slumps (per currently observed recent failure masses in the Southeast Corner, Pittsmont, and Neversweat Sectors).
[2]Slope failure due to continued erosion and undercutting by surface runoff, not due to rising pit water level.
[3]Includes potential failure volumes associated with the Bird Watch Dump.
Note: All elevations are referenced to the Anaconda datum, consistent with available cross-sections.

It is worth noting that even if the total volume of 1.864 million cubic yards of material were to slide instantaneously into the pit, the corresponding estimated rise in the pit water level is 3.2 feet, which accounts for slightly more than 4 month's worth of typical groundwater inflow. Thus, using information provided in the 2013 pit infilling model used by the Montana Bureau of Mines and Geology, the critical pit water level is estimated to be reached January 22, 2023, rather than the currently estimated date of May 26, 2023, a difference of 123 days (emails to MR July 30 and August 1, 2014, from Ted Duaime, Hydro-geologist, Montana Bureau of Mines and Geology, Montana Tech of the University of Montana).

A subsequent analysis by MR geotechnical staff, based on a 6.5-magnitude maximum credible earthquake and the assumption that all resulting slope failures in alluvium or dump areas would fail back to a 2H:1V (26^{o}) planar surface (rather than a typical rotational surface), has estimated the potential total volume of failure material at 3.626 million cubic yards (rather than 1.864 as reported above). The corresponding estimated rise in pit water level is 4.7 feet (rather than 3.2 feet, as indicated above). STRATA considers this predicted total failure volume to be excessively conservative (i.e., over-estimated) and, thus, it represents an unrealistic worst-case condition. Regardless, even if this predicted total slope failure volume ends up in the pit, the resulting impact on water level is small (less than 5 feet) and not overly significant.

Geotechnical Findings and Opinions

Potential slope instability in the Neversweat Sector primarily is due to oversteepening caused by localized stormwater erosion, which may lead to sloughing and thin, peel-like slope failures. Based on current observations, it is STRATA's opinion that large, deep-seated global slope failures are unlikely in this area.

In the Concentrator Sector, the toe of the Bird Watch Dump may experience shoreline erosion due to wave action, which may cause oversteepening and the potential for minor sloughing. In the eastern part of this sector, potential slope failure may involve steep, thin rotational slumps breaking out through alluvium overlying the leached cap (as previous analyzed at Cross-Section 36300 by STRATA; report to MR dated April 23, 2013).

Due to fill draped over the alluvium unit (about 150-feet thick) in the Southeast Corner Sector, STRATA expects that rising pit water level will induce a rising saturation level in the alluvium, decreasing the apparent cohesion through loss of soil matric suction and thus reducing slope stability. Potential slope instabilities likely will continue to be rotational, peel-like features similar to those seen in this area in late 2012. MR continues to monitor slope stability here using slope inclinometers, and initial detection of slope movements should provide sufficient warning of impending slope failures.

The thickest sequence of *insitu* alluvium and overlying fill occurs in the Pittsmont Dump area within the Pittsmont and Northeast Corner Sectors. Therefore, rising pit water level is expected to have the greatest influence on potential slope instability in this extreme eastern part of the Berkeley Pit. Additional subsurface exploration and sampling is being conducted here under BMFOU Geotechnical Study Task 2, as well as groundwater-level monitoring and installation of TDR cable (time-domain reflectometry) for slope displacement detection. A summary of that investigation is provided under a separate section for Task 2.

TASK 2: LABORATORY TESTING OF SUBSURFACE SAMPLES AND UPDATED SLOPE STABILITY ANALYSIS FOR THE PITTSMONT SECTOR

Geotechnical laboratory testing of drill hole PZF14-1A samples and an updated slope stability analysis for the Pittsmont Sector are the focus of this section. Pursuant to the “Work Plan” authorized by MR and AR on March 5, 2014, STRATA completed the following scope of services for Task 2:

1) Met with MR personnel to identify the location for this hole and define sampling protocols for retrieving representative cuttings of the Pittsmont Dump material. MR contracted with a driller to complete this hole and provided technical staff to log the hole and collect disturbed samples (cuttings). Though originally named PZF13-2 in the 2013 draft “Work Plan”, this initial exploration hole later was designated PZF14-1. However, due to hole caving and problems with extracting steel casing in efforts to complete the hole with TDR cable and piezometer, two additional holes (PZF14-1A and PZF14-1B) were drilled within 60 feet of this initial hole.
2) Conducted laboratory testing of the samples, including moisture content, Atterberg limits of the fines, particle size analysis, and 2 direct-shear tests of typical dump material. Remolded samples were compacted to a density considered representative of the in-situ dump material.
3) Interpreted the testing results and groundwater level data, and then used this new geotechnical information to update the slope stability models for the Pittsmont Dump. STRATA developed representative cross-sections for the stability analyses along previous designated lines 383E-N67W and 385E-N67W.
4) Prepared a draft letter to MR and AR summarizing STRATA’s findings and the results of the updated slope stability analysis. STRATA incorporated review comments and edits in the draft letter, and then converted it into this current report section for Task 2.

Field Work

Rotary drilling in the Pittsmont Sector to observe subsurface conditions (and to install groundwater piezometers and displacement-monitoring TDR cable) was overseen by MR personnel during the period February 24 through April 2, 2014, and included holes PZF14-1, PZF14-1A, and PZF14-1B. Hole locations are shown on Plate 1 (see attached Task 2 Appendix). The follow-up holes were drilled and completed after encountering difficulties in satisfactorily completing the initial hole. Draft well logs and completion details were provided to STRATA in May 2014 by MR personnel.

Drill-cutting samples were collected by MR personnel and bagged as composite samples over regular 10-foot intervals. Samples were dried and split, and then selected splits were shipped to STRATA's Missoula geotechnical laboratory in May and June. Samples that had been saved from 2013 for hole PZF13-1 also were shipped to the laboratory.

Laboratory Testing Results

The first set of bag samples was received by barrel on May 19, 2014, and testing was conducted from May 20 through July 10, 2014. Both fill and alluvium samples with obvious or suspected clay content were tested for Atterberg Limits (ASTM D4318) and the results are reported in Table A1 in Attachment 1 (see Task 2 Appendix). Those samples with significant amounts of sand and/or gravel were tested for particle-size analysis (ASTM C136 and C117). All laboratory testing results are presented in Attachment 1. A summary of the particle-size testing results is presented in Table 2. As expected, the rotary-drill cuttings composited in 10-foot intervals represent a mix/blend of materials encountered in each interval; therefore, the sieve results generally do not show much variability.

In general, the liquid limit and plasticity index results for the alluvium samples in PZF13-1, depths from 290 to 340 feet (middle portion of the alluvium unit), are fairly similar (clay) with only minor variability. A fat clay (CH) with high liquid limit and high plasticity was encountered at 430 to 440 feet, but samples below this depth had lower plasticity and were classified as silty clay or silt. The lower alluvium sampled in PZF14-1A also tended to be more silty (340 to 380 feet) with less plasticity than the overlying clay.

STRATA also tested 2 direct-shear samples of Pittsmont Dump fill material from Hole PZF14-1A, which were remolded and saturated prior to shearing. These test results were combined statistically with those from a fill sample obtained previously from Hole PZF12-7 to provide an estimated mean shear strength for the fill, with friction angle estimated at 29^o and cohesion (wet) = 419 psf and cohesion (dry) = 838 psf (see Attachment 1). STRATA tested wet samples assuming

Table 2. Summary of Sieve Analyses, Pittsmont PZF Rotary-Drilling Samples

Drill Hole ID	Material Type	Depth (ft)	Percent Gravel (4.75 – 75 mm)	Percent Sand (0.075 – 4.75 mm)	Percent Fines (< 0.075 mm)	Unified Soil Classification
PZF14-1A	Fill	0 – 10	12	61	27	SM[1]
PZF14-1A	Fill	10 – 20	19	59	22	SM with Gravel
PZF14-1A	Fill	20 – 30	18	59	23	SM with Gravel
PZF14-1A	Fill	30 – 40	16	63	21	SM with Gravel
PZF14-1A	Fill	40 – 50	12	60	28	SM
PZF14-1A	Fill	50 – 60	17	60	23	SM
PZF14-1A	Fill	60 – 70	11	60	29	SM
PZF14-1A	Fill	70 – 80	12	59	29	SM
PZF14-1A	Fill	80 – 90	6	59	35	SM
PZF14-1A	Fill	90 – 100	13	55	32	SM
PZF14-1A	Fill	100 – 110	12	61	27	SM
PZF14-1A	Fill	110 – 120	9	65	26	SM
PZF14-1A	Fill	120 – 130	12	65	23	SM
PZF14-1A	Fill	130 – 140	7	65	28	SM
PZF14-1A	Fill & Alluv.	140 – 150	7	65	28	SM
PZF14-1A	Alluvium	150 – 160	8	56	36	SC[2]
PZF14-1A	Alluvium	160 – 170	6	65	29	SC
PZF14-1A	Alluvium	170 – 180	3	61	36	SC
PZF14-1A	Alluvium	180 – 190	2	68	30	SC
PZF14-1A	Alluvium	190 – 200	8	67	25	SC
PZF14-1A	Alluvium	200 – 210[3]	3	72	25	SC
PZF14-1A	Alluvium	310 – 320	6	60	34	SC
PZF14-1A	Alluvium	320 – 330	8	54	38	SC
PZF14-1A	Alluvium	330 – 340	6	47	47	SC
PZF14-1A	Alluvium	340 – 350	7	57	36	SM
PZF14-1A	Alluvium	350 – 360	7	69	24	SM
PZF14-1A	Alluvium	360 – 370	16	65	19	SM with Gravel
PZF14-1A	Alluvium	370 – 380	12	73	15	SM
PZF14-1A	Alluvium	380 – 390[4]	4	87	9	SW-SM
PZF13-1	Alluvium	340 – 350	1	66	33	SC
PZF13-1	Alluvium	350 – 360	1	82	17	SM
PZF13-1	Alluvium	360 – 370	2	82	16	SM
PZF13-1	Alluvium	370 – 380	1	88	11	SW-SM
PZF13-1	Alluvium	380 – 390	1	65	34	SM
PZF13-1	Alluvium	390 – 400	1	58	41	SM
PZF13-1	Alluvium	400 – 410	0	65	35	SM
PZF13-1	Alluvium	420 – 430	1	71	28	SM
PZF13-1	Alluvium	440 – 450	4	52	44	CL
PZF13-1	Alluvium	450 – 460	1	67	32	SM
PZF13-1	Alluvium	480 – 490	1	64	35	SM

[1]SM is Silty Sand [2]SC is Clayey Sand [3]Volcanic flow from 220 to 295 feet [4]Bedrock at 383 feet

that such wetting reduces the effective matric suction in the soil, resulting in an estimated 50-percent reduction in the effective cohesion. Earlier 2013 estimates for fill friction angle and cohesion were 35^o and 240 psf, respectively.

MR's drilling logs from holes PZF14-1 and PZF 14-1A suggest that in this area approximately 600 feet north of PZF13-1 the alluvium unit is thinner and contains a volcanic flow "interbed" (235 feet compared to 340 feet) and that the alluvium generally is similar to the upper portion of the alluvium found farther south. The volcanic flow unit was identified within the alluvium overlying the leached cap. This volcanic layer has estimated thickness ranging from 70 to 80 feet.

No laboratory testing has been assigned to samples from this volcanic unit, as they appear to be light-colored sand and gravel, representing broken fragments and drilling chips from fractured rock; thus, plasticity and sieve testing is not applicable. Possibly, the lower alluvium in this locale experienced fluvial erosion at the ground surface, and then rhyolitic volcanic flows subsequently filled the depression prior to additional alluvium being deposited on top of it. Regardless of the geologic history, this volcanic unit likely improves overall slope stability in this northern portion of the Pittsmont Sector.

Slope Stability Analysis

Using recent geologic information obtained from 2014 drilling and sampling the subsurface materials in the Pittsmont Sector, STRATA conducted follow-up slope stability analyses using cross-sections 383E-N67W and 385E-N67W. Subsurface geology was updated using revised logging information from PZF13-1 for the first cross-section, and logging information from PZF14-1 and PZF14-1A for the latter cross-section. Hole PZF14-1B was shallow, completed to a depth of 157 feet, so that a piezometer and TDR cable could be placed in the fill material overlying the alluvium, which was encountered at a depth of 147 feet in this hole.

Original geotechnical material properties used in STRATA's previous stability evaluation (STRATA report to MR dated April 23, 2013) also were used in the current analyses, except for two revisions: 1) an updated linear shear strength model was used for the mixed fill within the Pittsmont Dump based on the 3 direct-shear test results presented in Attachment 1 (*Note:* estimated cohesion for unsaturated fill was assumed to be twice the value obtained from the saturated test samples, which is consistent with prior assumptions applied to alluvium materials in the Pittsmont Sector); and 2) the estimated friction angle for lower alluvium was increased from 21.4^o to 25.1^o to represent slightly more granular material seen in the recent drill logs, based on a value at 30 percent of the difference between the fines and granular strength estimates, $(21.4^o + 0.3x(33.7^o-21.4^o)) = 25.1^o$.

Estimated groundwater levels or elevations (GWL) for the stability analyses were based on recent monitoring information (cross sections and elevations here are referenced to the Anaconda datum; subtract 57 feet to convert to USGS datum):

1. Section 383E-N67W (PZF13-1) - GWL ranges from 5,480 to 5,476 feet (assume 5,480 feet in the backslope area with parabolic drawdown behind the slope face to match assumed pit water level)
2. Section 385E-N67W (PZF14-1A) - GWL for the upper piezometer installed in alluvium is 5,396 feet, and GWL for the lower piezometer installed in the underlying leached cap is 5,341 feet (assume 5,396 feet in the backslope area with parabolic drawdown behind the slope face to match assumed pit water level)

Results of the slope stability analysis for section 383E-N67W are shown in Figures 1 though 3 in Attachment 2 (see Task 2 Appendix). The minimum computed Factor of Safety (FOS) value for potential rotational failure paths is 1.006 (Figure 1A), considering pit water level at 5,313 feet (i.e., 5,370 feet Anaconda datum), the approximate current pit water level. This model output with FOS nearly 1.0 well represents actual field conditions, in that tension cracks are visible along the ground surface in this area. It also reinforces the decision/plan to have active TDR monitoring of potential slope displacement here. As pit water level rises, the computed minimum FOS values are: 1.002 for pit water level at 5,343 feet (5,400 feet, Anaconda datum) (Figure 2A) and 1.015 for critical pit water level at 5,410 feet (5,467 feet, Anaconda datum) (Figure 3A). Dewatering (pumping) to lower the GWL 30 feet from 5,423 to 5,393 feet in this area slightly increases the minimum FOS value to 1.012 for pit water level at 5,343 feet (5,400 feet, Anaconda datum) (Figure 2B).

Results of the slope stability analysis for section 385E-N67W are shown in Figures 4 and 5 in Attachment 2. The minimum computed Factor of Safety (FOS) value for potential rotational failure paths is 1.257 (Figure 4A), considering pit water level at 5,313 feet (5,370 feet, Anaconda datum). Higher FOS values here likely are due to the lower GWL in the backslope area and to the presence of the volcanic flow unit, which helps to strengthen the toe area of the slope for full-height failure paths. As pit water level rises to the critical elevation of 5,410 feet (5,467 feet, Anaconda datum), GWL in the backslope area is expected to rise along with it until reaching critical level; thus, lower FOS values are expected as this occurs (minimum computed FOS is 1.173; Figure 5A).

Geotechnical Findings and Opinions

Current slope stability modeling suggests that slope areas to the north of Section 383E-N67W (i.e., north and northwest of the currently observed tension cracks in the Pittsmont dump) likely are more stable than those areas currently exhibiting tension cracking, where MR continues to monitor with a TDR system. The primary area of concern is near/along Section 383E-N67W, where PZF13-1 is located. A measured GWL above 5,423 feet in this hole (5,480 feet, Anaconda datum), or any detection of deformation in the TDR cable should trigger immediate concern for potential slope movement here. Because no signs of fresh slope movement were noted during the drilling program and during the spring snowmelt (and particularly during/after an extreme precipitation event in the first week of March, 2014), it appears this area of the Pittsmont Dump is temporarily stable. The slope stability analysis results also indicate that there is very little, if any, reduction in the expected stability over the next several years as pit water level approaches 5,343 to 5,353 feet (5,400 to 5,410 feet, Anaconda datum).

It is STRATA's opinion that continued, consistent monitoring of GWL and the TDR system should allow detection of potential ground displacements that may indicate imminent slope movement in this area.

TASK 3: ORIENTED-CORE DATA ANALYSIS IN THE CONCENTRATOR SECTOR

Geotechnical work associated with oriented-core hole PZF14-2 (e.g., logging, sampling, testing, and data analysis) is the focus of this section. Pursuant to the "Work Plan" authorized by MR and AR on March 5, 2014, STRATA completed the following scope of services for Task 3:

1) Met with MR personnel to identify the location for this hole and establish the bearing and plunge of the hole to intersect the leached cap unit and core through the cap until sulfide quart monzonite is encountered. MR contracted with a driller to complete this hole (and scribe the core) and also provided technical staff to oversee the drilling. Final depth of the inclined hole was 293.5 feet.
2) Logged the oriented core in the leached cap and quartz monzonite to record rock type, fracture locations (depths), orientation of fractures (dip direction and dip), and fracture filling. Collected representative samples for subsequent laboratory testing.
3) Conducted laboratory testing of core samples, including density, unconfined compressive strength, and direct-shear strength along discontinuities. Drill core is available if MR desires to conduct Point Load testing per typical company practice.
4) Interpreted the logging and testing results, then developed stereonet plots of fracture orientations to identify any structural trends.
5) Conducted slope stability analyses using the new information, focusing primarily on deeply seated potential failure paths through the leached cap.
6) Prepared a draft letter to MR and AR summarizing STRATA's data analysis, geotechnical findings, and the results of the updated slope stability analysis. STRATA incorporated review comments and edits in the draft letter, then converted it into this current report section for Task 3.

Field Investigation

MR constructed an access ramp and drill pad as far east as possible on the Bird Watch Dump in order to place a drill rig for coring an angled hole into the Concentrator Sector slope (refer to Plate 1 in Task 3 Appendix). This pad site was relocated (due to access and safety reasons) from the original plan calling for a location farther east to drill a south-bearing hole. This oriented-core hole, designated PZF14-2, was drilled March 19-23, 2014, with MR personnel monitoring on-site work by the drilling contractor, and STRATA conducting the oriented-core logging and subsequent data analysis to derive rock discontinuity orientations in the form of dip direction and dip. A cross-section showing the approximate subsurface trace of the drill hole is provided as Plate 2.

The angled hole encountered mixed mine backfill until intercepting the top of the leached bedrock (Leached Cap Unit) at a depth of 151 feet. The base of the leached cap was identified at a depth of 199.3 feet. In general, core recovery was excellent, being nearly 100 percent for depths beyond 160 feet. RQD (Rock Quality Designation) averaged 62 percent in the leached cap and 63 percent in the sulfide quartz monzonite. STRATA used a Plexiglas goniometer device to measure the apparent dip direction and dip of each planar or semi-planar natural rock discontinuity observed in the drill core. Discontinuities were identified as either joints, faults, or contacts (typically a contact between the host rock and a dike). STRATA also collected several core samples for subsequent laboratory testing.

The true dip direction and dip of each discontinuity then was derived using an analytical procedure based on knowing the bearing and plunge of the drill hole. A post-drilling borehole survey conducted by MR indicated the completed hole had an average bearing (azimuth) of 129.5^{o} (i.e., southeast) and average plunge (dip) of 47.2^{o}. The derived rock-discontinuity orientation results are reported along the right side of the *Core Logging Report* in Attachment 1 (see Task 3 Appendix).

Data Analysis

Rock discontinuity orientations obtained from drill hole PZF14-2 were displayed on lower-hemisphere stereonet plots (see *Stereonet Plots of Rock Discontinuity Orientations* in Attachment 1). These plots display the poles (normals) to the rock fracture planes. Of particular geotechnical interest in this case are any observed fracture poles plotted in the south to south-southwest portion of the graph, as these represent geologic discontinuities (structures) dipping northward into the Berkeley Pit.

STRATA initially plotted the leached-cap structures on one plot per depth interval 160 to 199 feet (shown as Figure A1, Attachment 1) and the quartz monzonite structures on 2 plots per depth intervals 199 to 240 feet and 240 to 292 feet (shown as Figures A2 and A3, Attachment 1). Because the latter 2 stereonet plots were similar, indicating similar structural orientation patterns, STRATA combined those quartz monzonite orientation data into a single plot covering the depth interval 199 to 292 feet (shown as Figure A4, Attachment 1). STRATA identified and labeled fracture sets (i.e., clusters of poles) for the leached cap (Figure A5, Attachment 1) and for the quartz monzonite (Figure A6, Attachment 1).

In general, the structural patterns in the 2 rock units are similar. That is, the fracture sets observed in the leached cap also are seen in the quartz monzonite. It is also important to note that few fracture poles occur in the south to south-southwest portion of the leached-cap stereonet plot. This means that critically oriented structures are lacking and that potential plane shear failures are unlikely. The only possible plane shears may occur on joints in Set 4.3 with north-northeast dip directions and dips of approximately 35^o to 40^o. Also, there is a potential for 3-dimensonal wedge failures formed by Sets 31.4 and 7.6 (refer to Figure A5), where sliding could occur along the wedge intersection line oriented to the north-northeast and plunging 30^o to 40^o. Therefore, in analyzing possible deep-seated slope failure paths through the leached cap, STRATA expects the most viable paths will be dipping 30^o to 40^o, and they should be assigned representative shear strengths estimated from direct-shear tests of natural discontinuities.

In regards to fracture-set characteristics for the 3 sets mentioned above, Set 4.3 is comprised of joints with mean roughness of 1.4 and mean spacing of 3.1 feet (refer to *Rock Discontinuity Set Information* at the end of Attachment 1). Set 31.4 is comprised of joints and faults with mean roughness of 1.3 and mean spacing of 2.0 feet. Set 7.6 is comprised of joints and faults with mean roughness of 2.0 and mean spacing of 0.6 feet.

Laboratory Testing Results

Core samples collected from PZF14-2 were wrapped and sealed, then transported to STRATA's geotechnical laboratory in Gillette, Wyoming, or to a contracted testing laboratory in Lakewood, Colorado (Advanced Terra Testing Inc.), in the case of the direct-shear tests of natural rock joints. The testing program included 3 unconfined compression tests, 2 direct-shear tests of remolded sandy fill material, and 3 direct-shear tests of natural rock joints. Results from the laboratory testing are reported in Attachment 2 and are summarized below in Tables 3 and 4.

Table 3. Summary of Unconfined Compression Test Results

Drill Hole ID	Rock Type	Depth (ft)	Core Size	Alteration Intensity	Unit Weight (pcf)	UCS (psi)
PZF14-2	Leached Cap	168.0-168.5	HQ3	Extensive	136.0	61
PZF14-2	Leached Cap	190.5-191.2	HQ3	Extensive	138.9	78
PZF14-2	QM	220.5-221.2	HQ3	Major	149.0	514

Table 4. Summary of Direct-Shear Test Results (Residual Strength)

Drill Hole ID	Material and Test Type	Depth (ft)	Normal Stress Range (psf)	Est. Cohesion (psf)	Est. Friction Angle (°)	Power Model[1]	
						A	B
PZF14-2	Mixed Fill; Remolded	132	1,000 – 12,020	94	38.2	0.8426	0.9941
PZF14-2	Mixed Fill; Remolded	150	1,000 – 12,020	699	33.1	4.3694	0.8058
Combined	Sandy Fill: (2)PZF14-2 (1)PZF12-7 (1)MRD1973[2] (1)GA1980[3]	- -	1,000 – 12,020	- -	- -	**1.9341**	**0.8942**
PZF14-2	Leached Cap Natural Joint	172.5	2,200 – 15,000	3,867	25.7	154.839	0.4415
PZF14-2	Leached Cap Natural Joint	182.0	2,200 – 15,000	1,930	16.8	52.451	0.4984
Combined	(2)Leached Cap	- -	2,200 – 15,000	**1,930**[4]	**21.2**[5]	- -	- -
PZF14-2	Qtz. Monz. Natural Joint	212.0	2,200 – 15,000	1,449	22.2	13.4796	0.6568

[1]Power shear-strength model, $\tau = A\sigma^B$ (where τ is shear strength and σ is effective normal stress).
[2]Hoskins MRD Report, 1973
[3]Golder Associates Report, 1980
[4]Based on the lesser of the two cohesion values
[5]Based on the average of the two friction angle values (the combined parameters allow for directional anisotropic modeling of shear strength in subsequent slope stability modeling)

Unconfined compressive strengths of the leached cap and quartz monzonite samples were lower than expected. Due to the high degree of alteration (described as major to extensive), these samples had compressive strengths less than 520 psi (pounds per square inch). The measured lowest value of 61 psi (8,780 psf) suggests that potential failure paths through the leached cap may pass through the weak rock substance (especially for steep portions of the path), as well as along rock fractures. This intact strength was used to help assign anisotropic strength characteristics to the leached cap for slope stability analysis.

Direct-shear testing results for the current PZF14-2 samples of remolded sandy fill were generally similar to earlier STRATA results for a sample from hole PZF12-7 (located about 1,400 feet to the east of PZF14-2) and to historical test results of the fill from the mid to late 1970's. Therefore, STRATA statistically combined the results from 5 such sandy fill samples to obtain an overall mean shear strength relationship using the power model (shown in Table 4), which is assigned to the mixed fill unit in subsequent slope stability modeling. More detailed information is provided in Attachment 2 under the section *Laboratory Testing: Direct Shear Results*.

In regards to assigning a discontinuity/fracture shear strength to the leached cap for slope stability modeling, STRATA used the lesser of the two reported cohesion values, and calculated the mean of the two estimated friction angle values (25.7^{o} and 16.8^{o}). This overall estimated strength is reported in Table 4.

Slope Stability Analysis

Using the recent geotechnical information obtained from drilling and sampling oriented core hole PZF14-2 in the Concentrator Sector, STRATA conducted follow-up stability analyses of the Berkeley Pit slope at cross-section 36300. As shown in Attachment 3, Figure 1, the original analysis indicated the critical failure path daylighted at the base of the alluvium (i.e., top of the leached cap). Using updated shear strength information for the fill unit (power shear strength model, Table 4) and a modeled anisotropic shear strength for the leached cap, STRATA re-analyzed the slope stability with the same assumed groundwater and pit water level conditions (Attachment 3, Figure 2). This updated model shows a slightly smaller value for the minimum computed Factor of Safety (FOS), and the critical failure path is deeper, passing through the leached cap. The numerical difference between the two FOS values shown in Figures 1 and 2 is well within uncertainty levels and modeling errors.

When considering rising pit water level, Figures 2 through 4 illustrate that additional water resting on the submerged leached cap slope may have a small stabilizing influence on potential deep-seated failure paths, as the minimum computed FOS value is 1.148 for pit water level at 5,373 feet (5,430 feet, Anaconda datum) which is slightly higher than that for lower pit water levels. However, the rising pit water level also saturates the lower reaches of the alluvium overlying the leached cap, which decreases soil matric suction and causes a loss in apparent cohesion (as discussed in STRATA's previous report to MR dated April 23, 2013). Thus, the current slope stability modeling suggests that the primary de-stabilizing impact on Berkeley Pit slopes as pit water level rises is expected to be within the alluvium and fill units overlying the leached cap, not within the leached cap itself.

Geotechnical Findings and Opinions

Measured orientations of bedrock leached-cap discontinuities in oriented-core hole PZF14-2 indicate that potential slope failure paths may occur along minor fracture sets dipping into the Berkeley Pit. However, most of the structures observed are oriented in a favorable direction in regards to slope stability.

Assuming that potential failure paths could coincide with or step along the critical fracture sets, corresponding slope stability modeling of potential paths through the leached cap indicates acceptable FOS values. If potential groundwater levels in the backslope area are assumed to rise several feet, the computed FOS values decrease to marginally acceptable values.

CLOSING REMARKS

Rising pit water level will continue to increase the potential for slope failure, especially in the southeastern part of the Pit. Future slope failures are expected to occur in in this area, but they are expected to have only a minor influence on the water level in the Berkeley Pit. There are inherent uncertainties and risks when analyzing mine slope stability due to heterogeneous geologic and hydrogeologic conditions, and to limitations of the exploration and evaluation methods. STRATA has relied on current geotechnical exploration, sampling, and testing information, as well as reasonable assumptions based on professional experience and available knowledge of geologic conditions expected in the study area. As additional information becomes available in the future, STRATA's assumptions and analyses should be updated accordingly, which may require revisions to the geotechnical findings and opinions.

STRATA's services consist of geotechnical evaluations and professional opinions provided in accordance with current, generally accepted geotechnical engineering principles and practices. This report is specifically for this project and exclusively for the use of MR and AR, and the evaulation applies only to the Pit Sectors and cross-sections analyzed. Extrapolation of any geotechnical conclusions to other projects or sites in the area is not recommended. Furthermore, this report does not provide specific recommendations regarding any geotechnical monitoring or mitigation activities that may be used to manage potential risks, because such recommendations are beyond the scope of STRATA's current engagement by MR and AR.

STRATA appreciates the opportunity to provide this summary report describing the authorized geotechnical evaluation for the BMFOU study of overall slope stability at the Berkeley Pit. STRATA remains available to respond to any questions or provide any additional information as requested.

REFERENCES

Hoskins, W.N. (1973), Slope Stability of the Concentrator Sector, Berkeley Pit, Butte, Montana; Anaconda Mining Research Dept., Tucson, AZ, 58 p.

Pincock, Allen & Holt, Inc. (1978), Berkeley Pit Slope Design; prepared for The Anaconda Company, Butte, Montana, 268 p.

Golder Associates, Inc. (1980), Alluvium Strength Testing Program, East Berkeley Pit Expansion, Butte, Montana; prepared for The Anaconda Company, 114 p.

Knight Piesold Ltd. (1999), Montana Resources Berkeley Pit: Concentrator Slope Stability Status Report, 68 p.

TASK 1 – APPENDIX

ATTACHMENT 1

Figure 1 – Figure 3

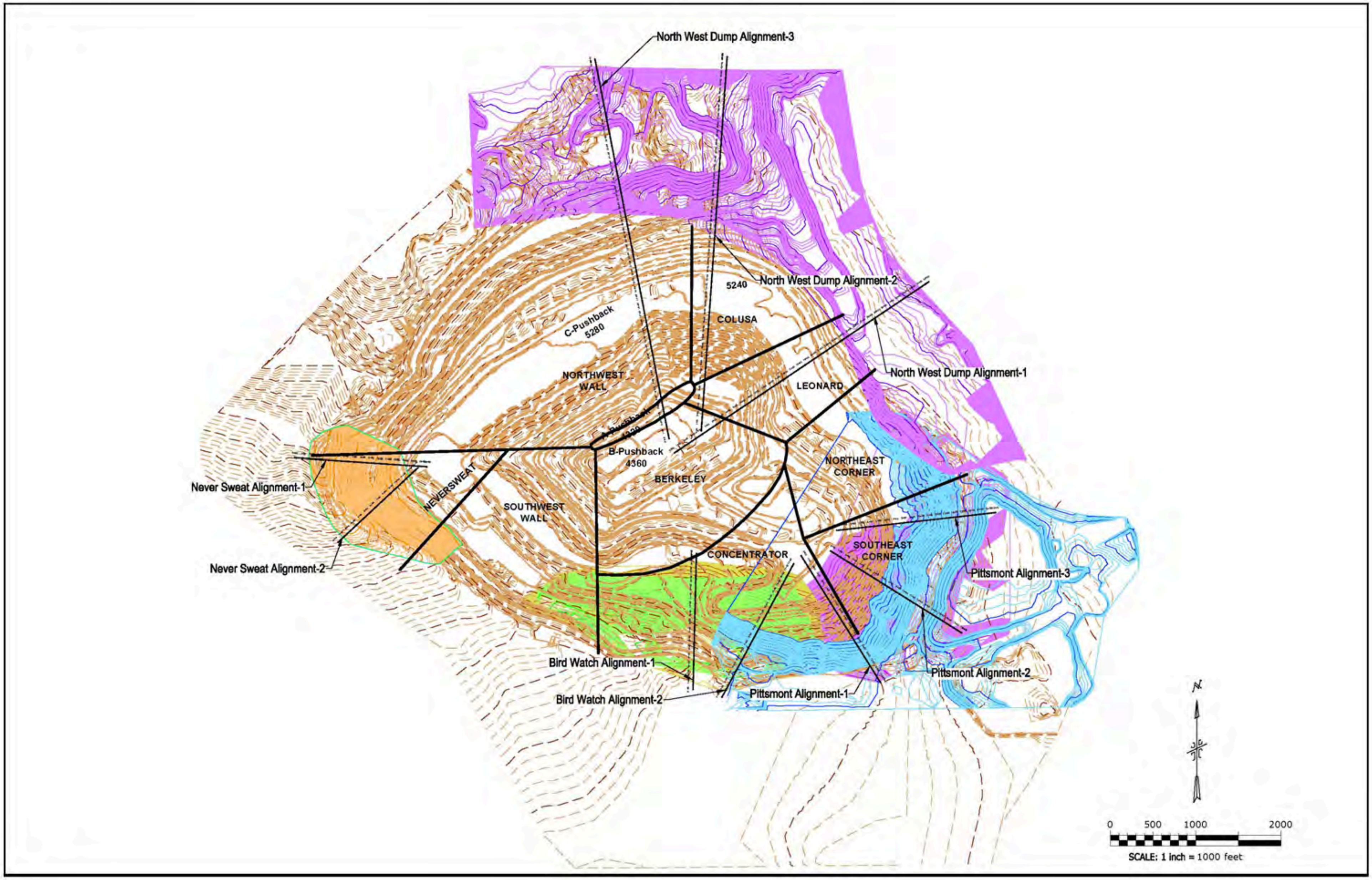

Figure 1. Original pit slope design sectors for the Berkeley Pit and locations of STRATA cross-sections (Note: colored areas contain mine waste/fill)

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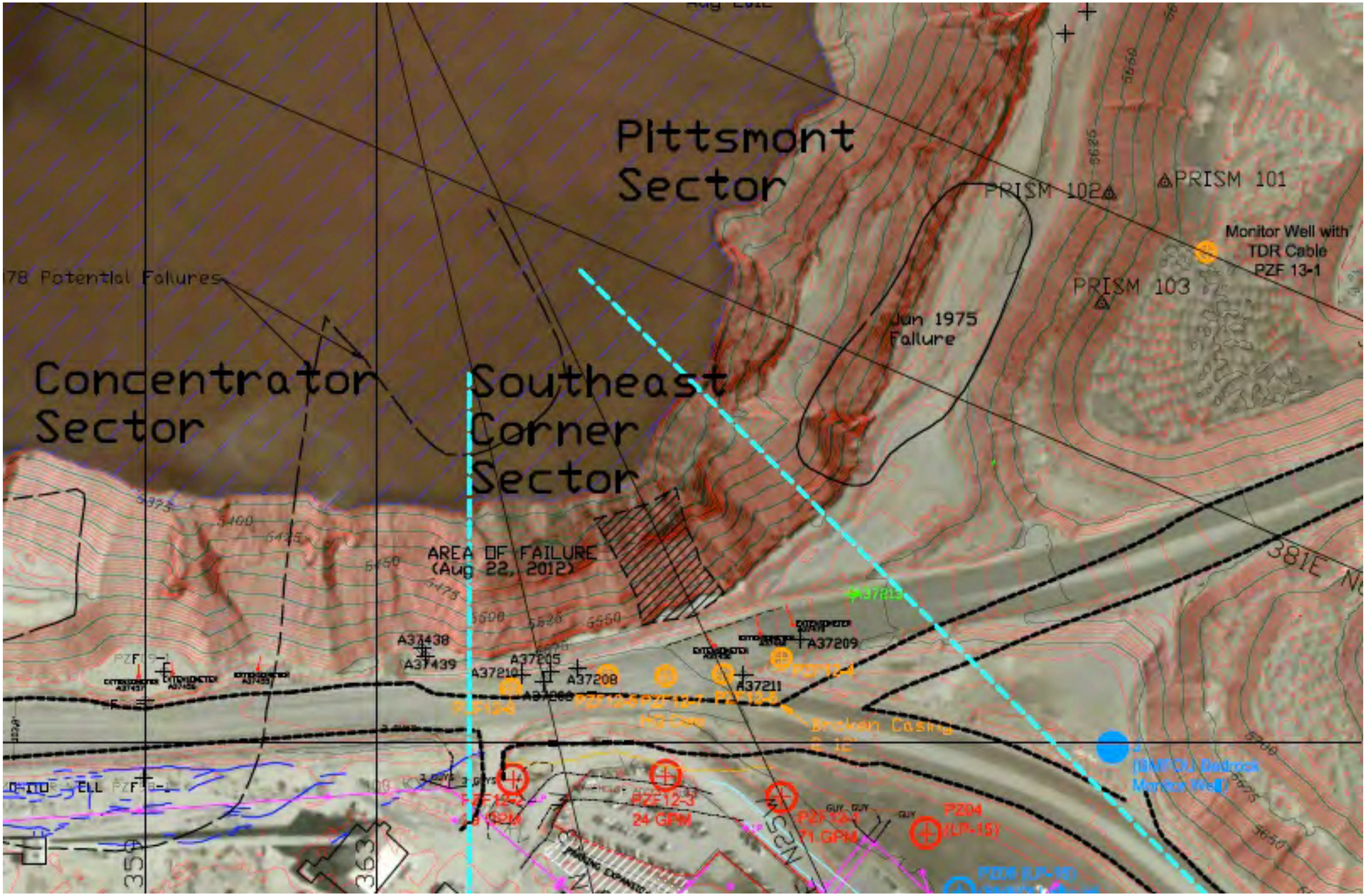

Figure 1A. Re-designation of sectors in southeast area of Berkeley Pit.

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MI14010A

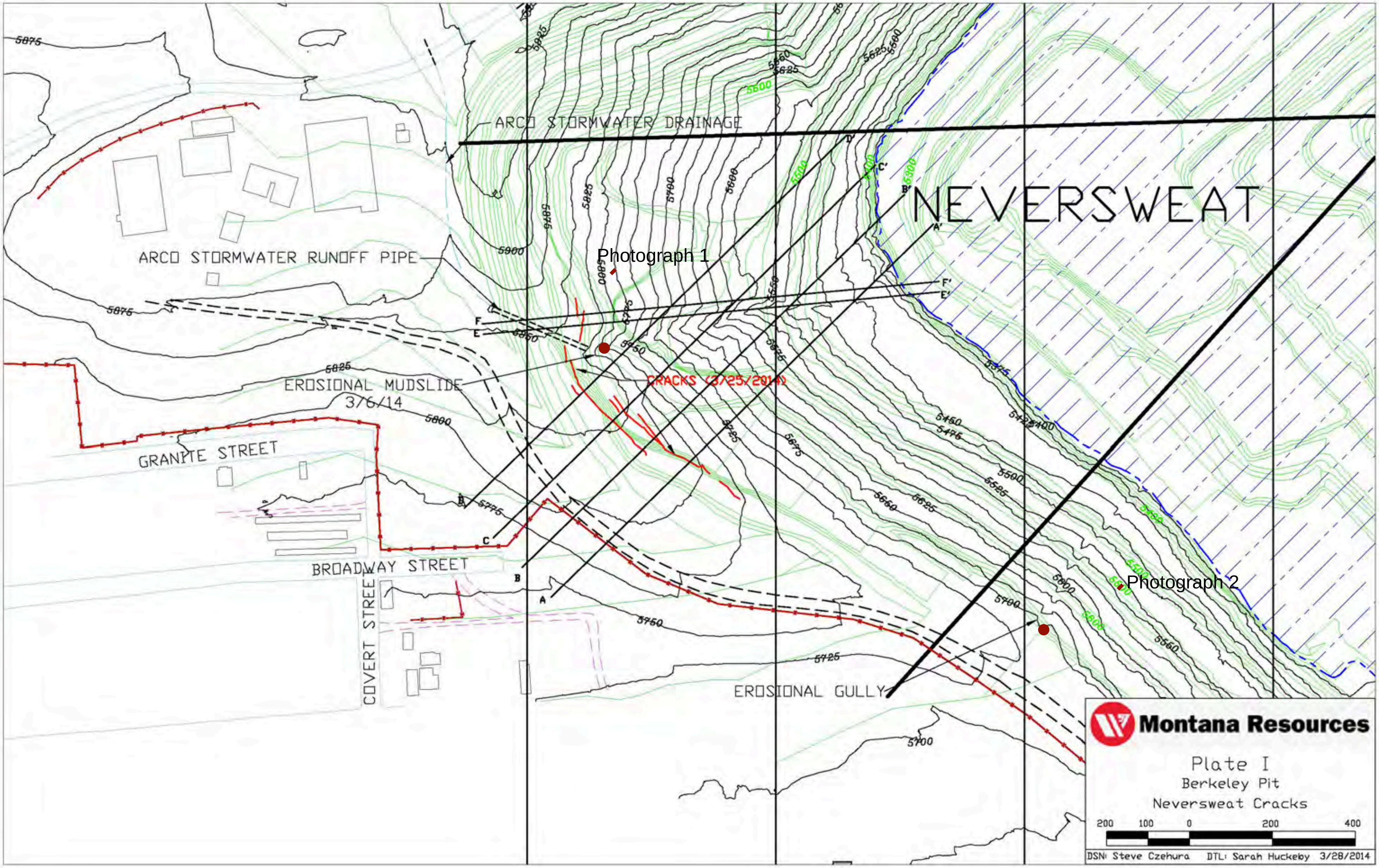

Figure 2. Neversweat Sector showing locations of observed tension cracks and surface erosional features.

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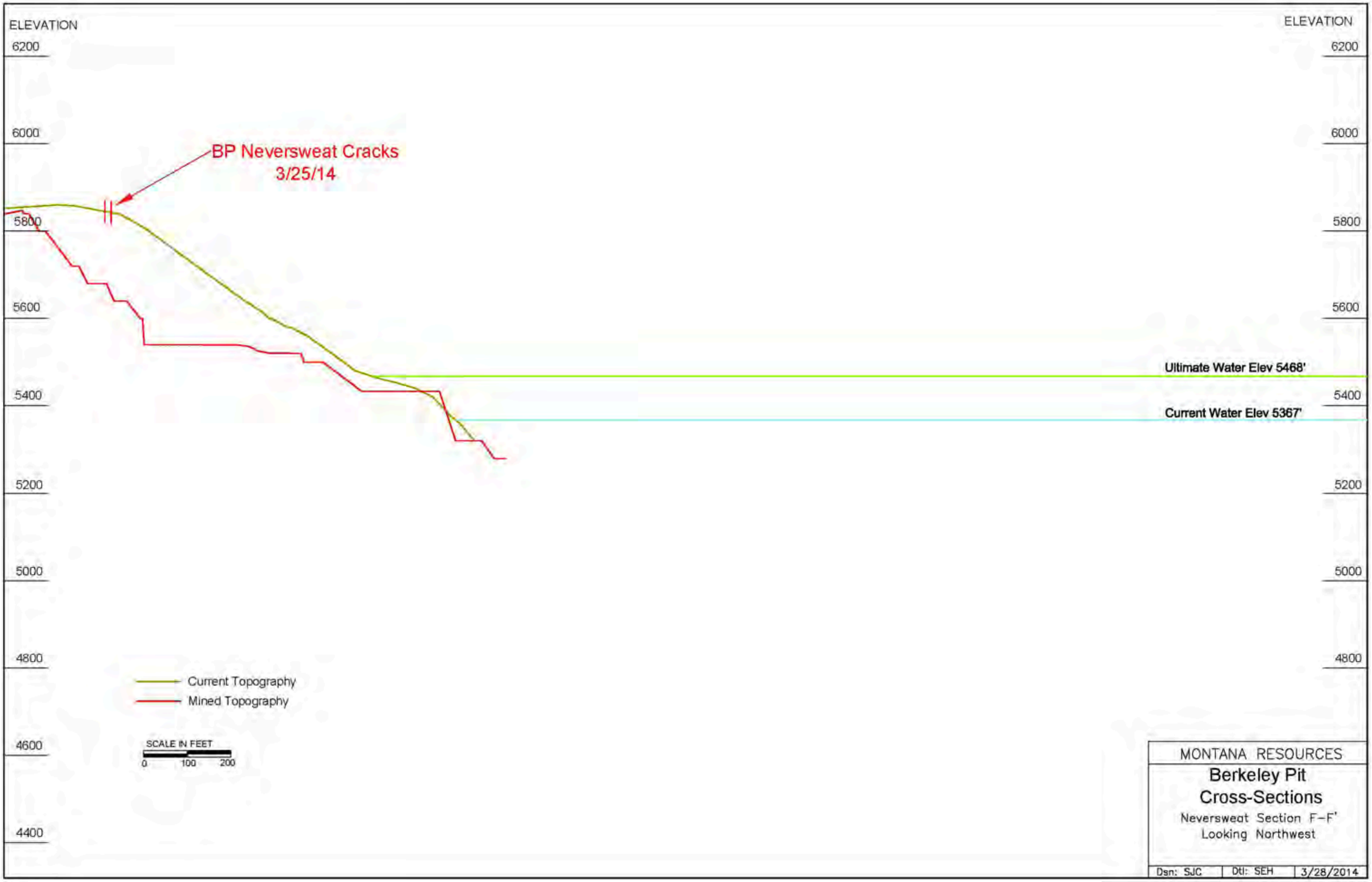

Figure 3. Neversweat Sector cross-section F-F' showing tension cracks and scale of potential slope failure in fill material.

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ATTACHMENT 2

Photograph 1 – Photograph 4

Photograph 1. Neversweat Sector: Stormwater outlet and headscarp of erosional mudslide area.

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Photograph 2. Neversweat Sector: Erosional gulley in southeast portion of this Sector.

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Photograph 3. Neversweat Sector: Headscarp and tension cracks related to slope movement in the fill.

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Photograph 4. Pittsmont Dump (center) and Bird Watch Dump (right); looking east.

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ATTACHMENT 3

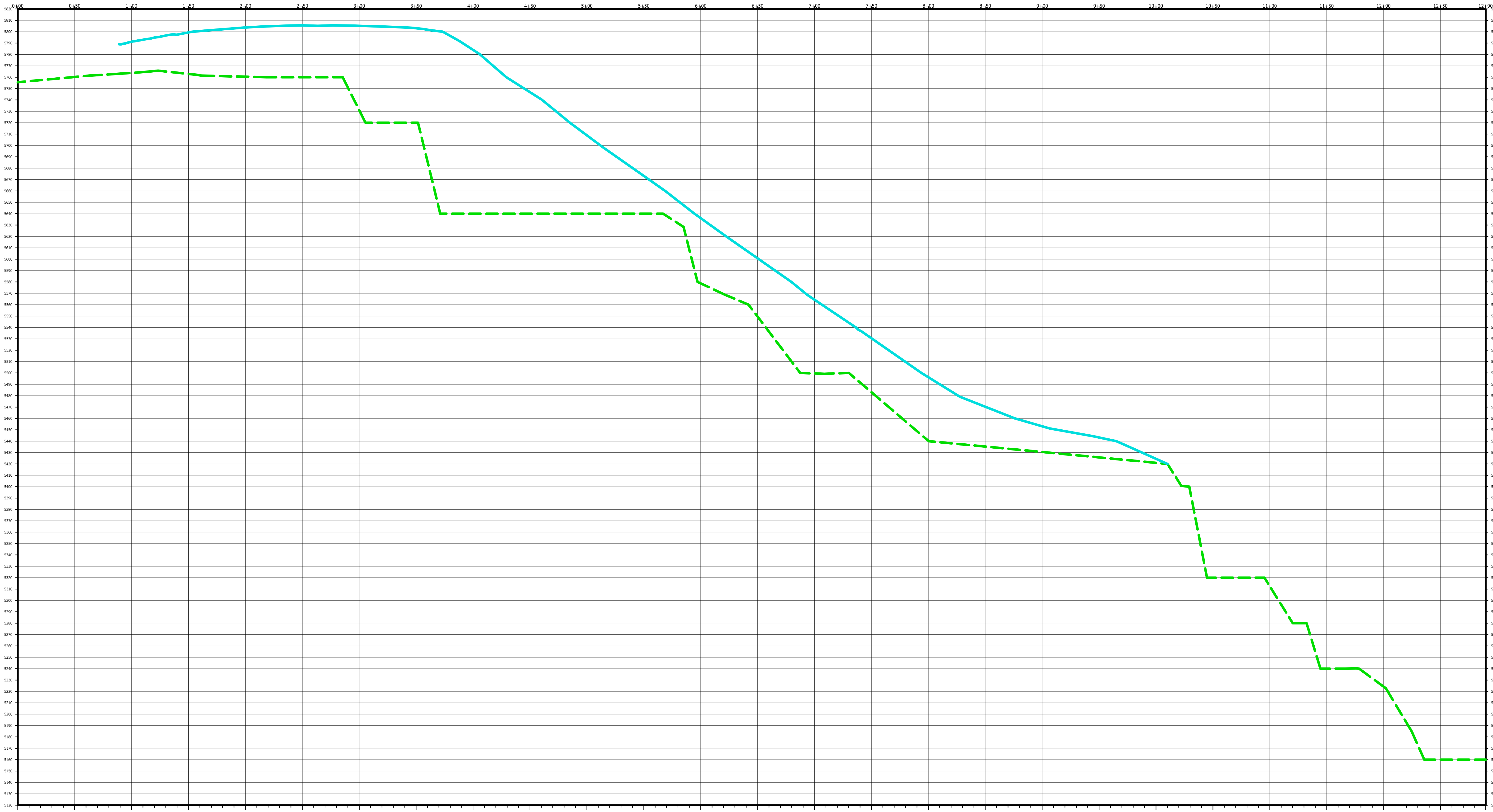
Alignments (Cross-Sections) through Major Fills and Dumps at the Berkeley Pit

Key for Colored Lines

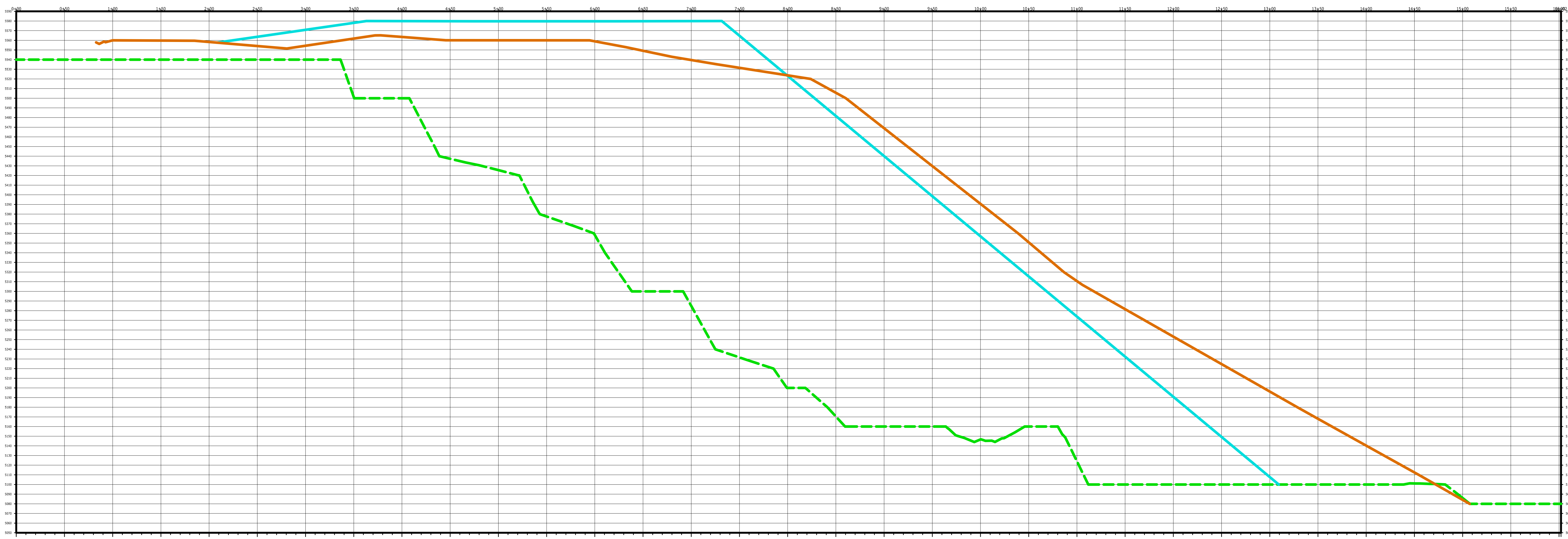
Green: Mine Slope Topography
Blue/Purple: Pre-1998 Fill Topography
Brown/Red/Pink: Post-1998 Fill Topography

NEVER SWEAT 1 PROFILE
0+00 TO 15+59

NEVER SWEAT 2 PROFILE
0+00 TO 12+90



BIRDWATCH-1A PROFILE
0+00 TO 16+02



BIRDWATCH-2 PROFILE
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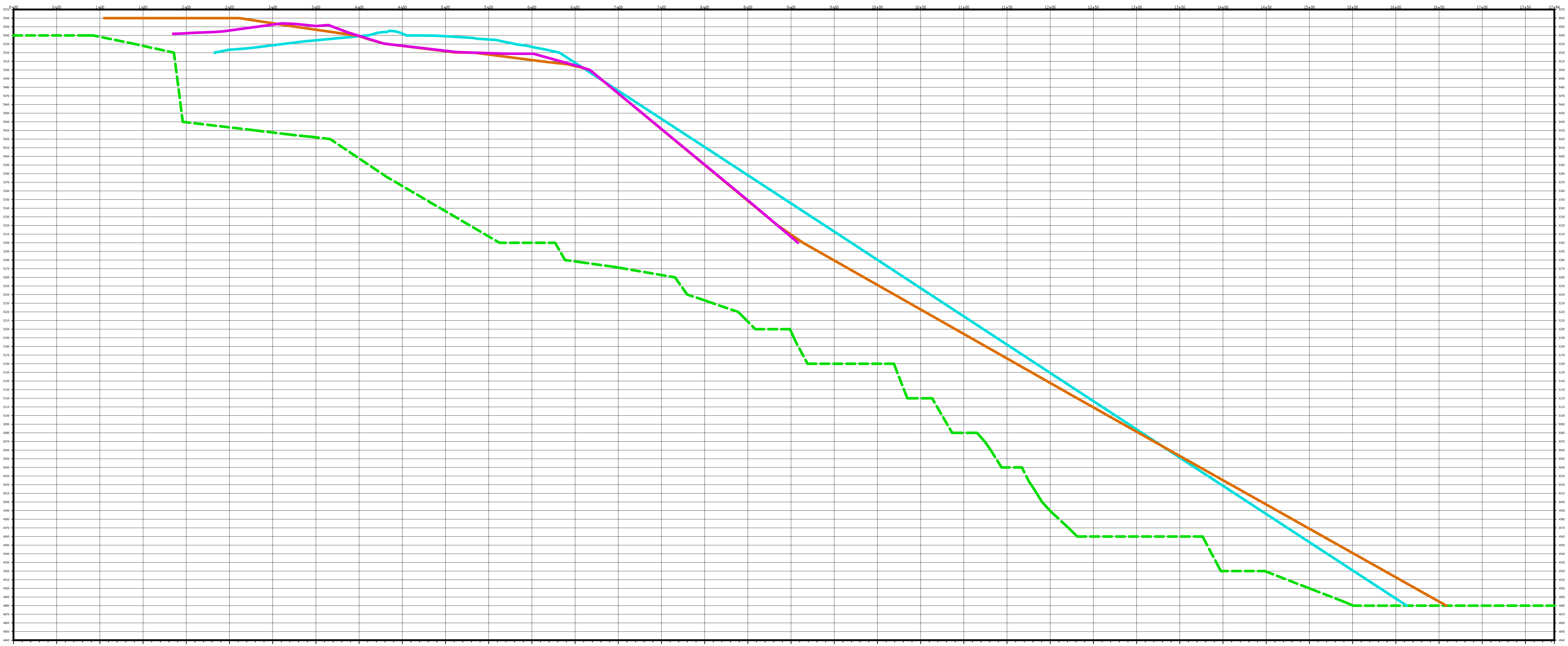
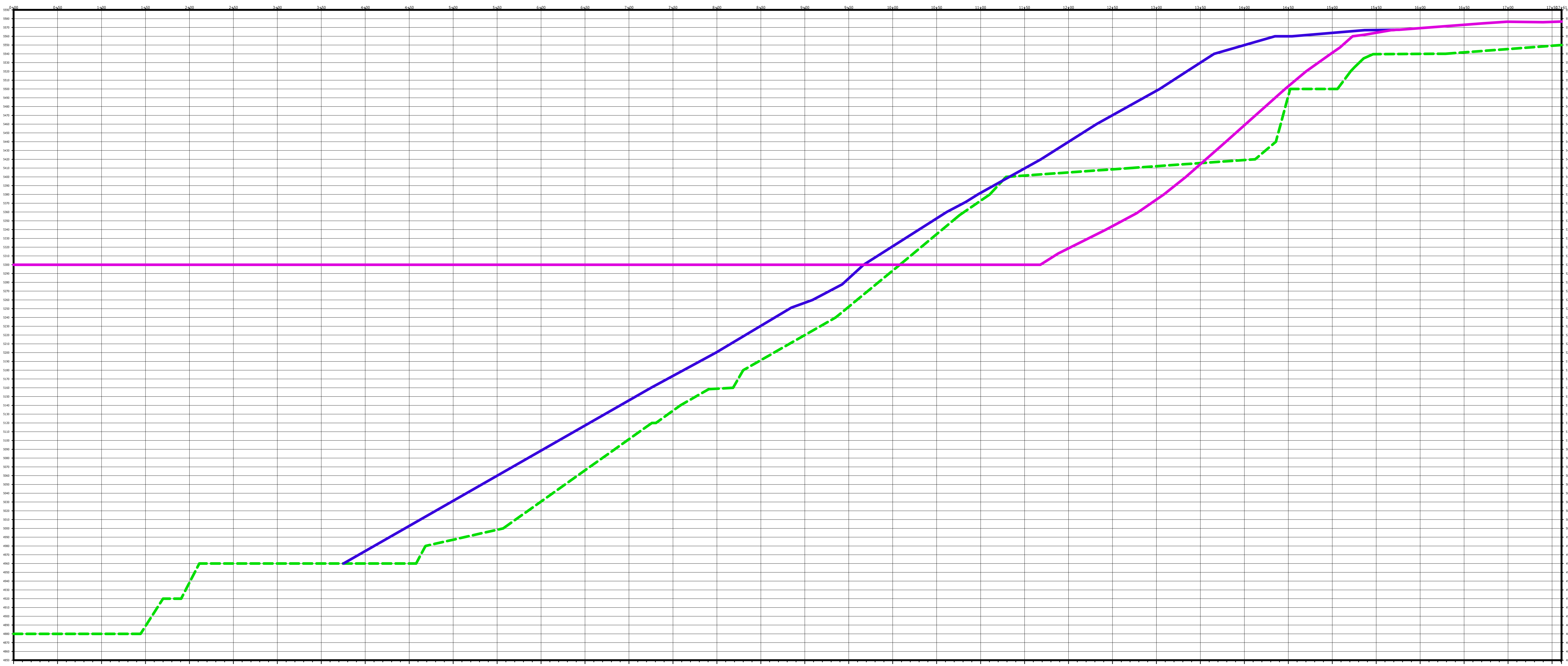
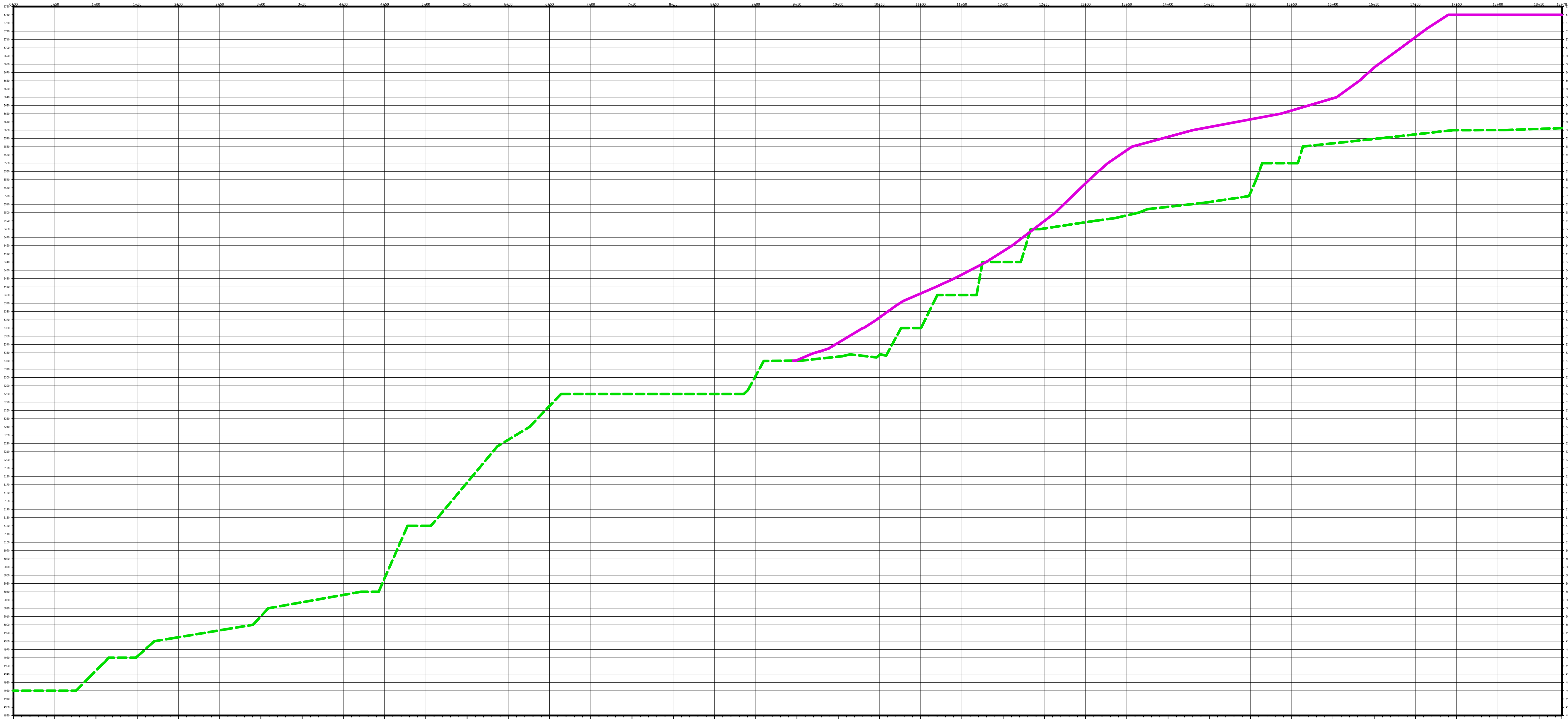


PITTSMONT-1 (1) PROFILE
0+00 TO 17+61

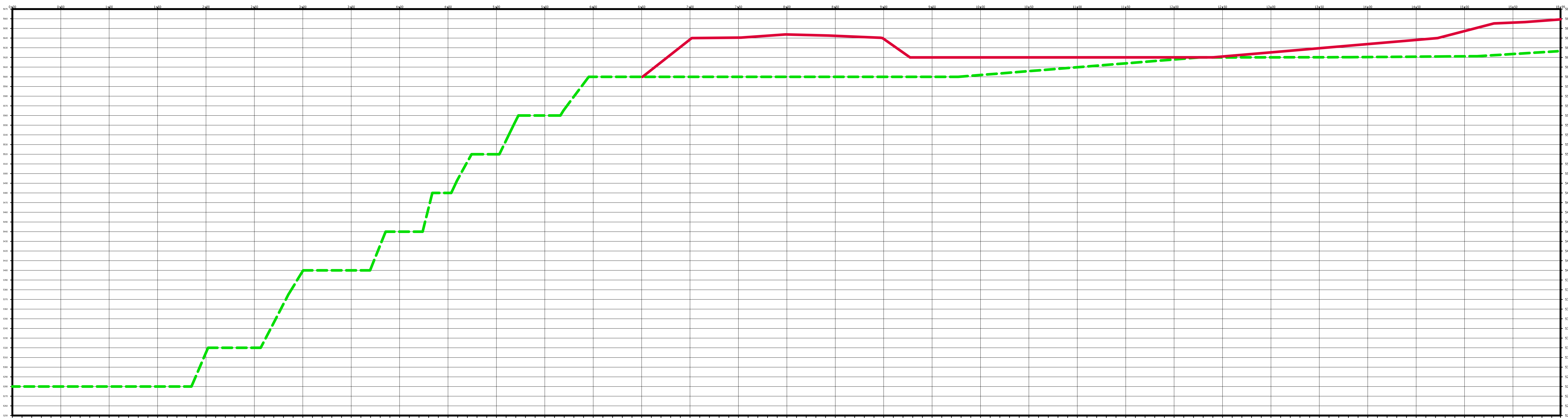


PITTSMONT-2 PROFILE
0+00 TO 18+16

PITTSMONT-3 PROFILE
0+00 TO 18+78



NW-DUMP-1 PROFILE
0+00 TO 15+99



NW DUMP-2 PROFILE
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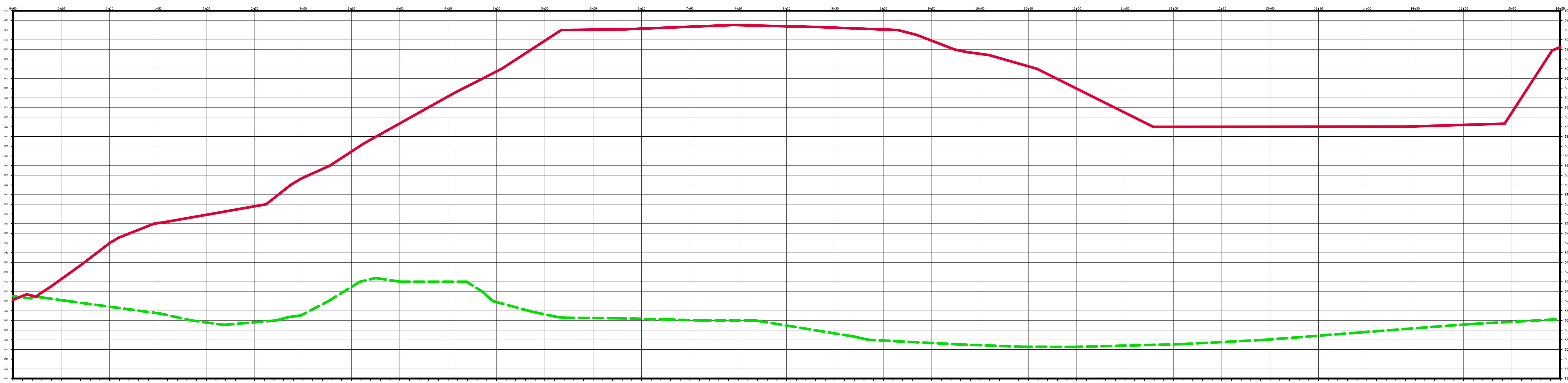
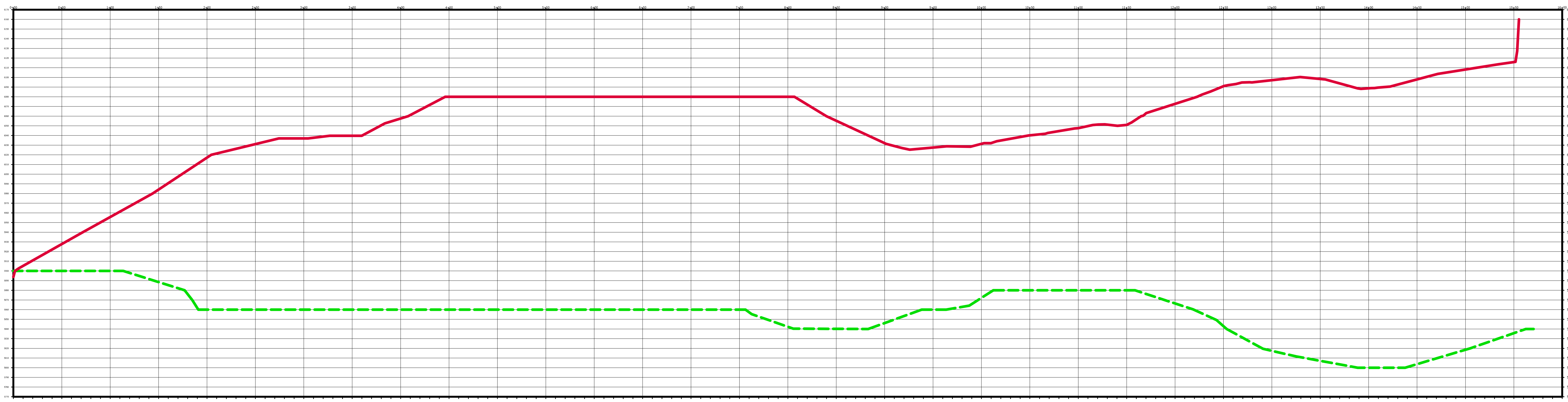
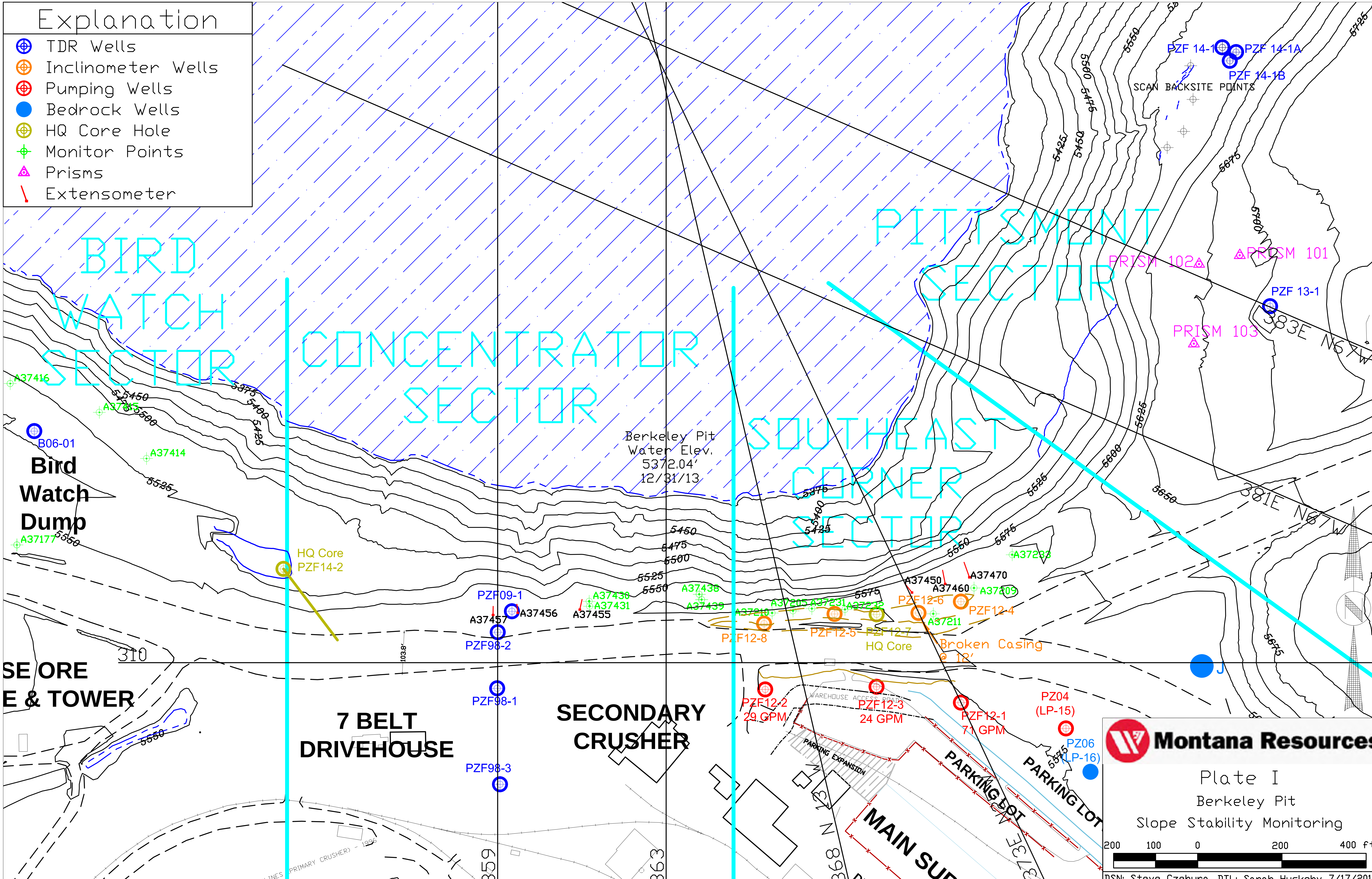


NW-DUMP-3 PROFILE
0+00 TO 16+00



TASK 2 – APPENDIX

Plate 1


Explanation
TDR Wells
Inclinometer Wells
Pumping Wells
Bedrock Wells
HQ Core Hole
Monitor Points
Prisms
Extensometer
BIRD WATCH SECTOR
CONCENTRATOR SECTOR
PITTSMONT SECTOR
SOUTHEAST CORNER SECTOR
Berkeley Pit Water Elev. 5372.04′ 12/31/13
Bird Watch Dump
HQ Core PZF14-2
PZF09-1
PZF98-2
PZF98-1
PZF98-3
PZF12-2 29 GPM
PZF12-3 24 GPM
PZF12-1 71 GPM
PZF12-4
PZF12-5
PZF12-6
PZF12-7 HQ Core
PZF12-8
Broken Casing @ 12′
PZ04 (LP-15)
PZ06 (LP-16)
PZF 14-1
PZF 14-1A
PZF 14-1B
PZF 13-1
PRISM 101
PRISM 102
PRISM 103
SCAN BACKSITE POINTS
B06-01
SE ORE
E & TOWER
7 BELT DRIVEHOUSE
SECONDARY CRUSHER
PARKING LOT
PARKING LOT
MAIN SUR
383E N67W
381E N67W
Montana Resources
Plate I
Berkeley Pit
Slope Stability Monitoring
200 100 0 200 400 ft
DSN: Steve Czehura DTL: Sarah Huckeby 7/17/2014

ATTACHMENT 1

Laboratory Testing Results

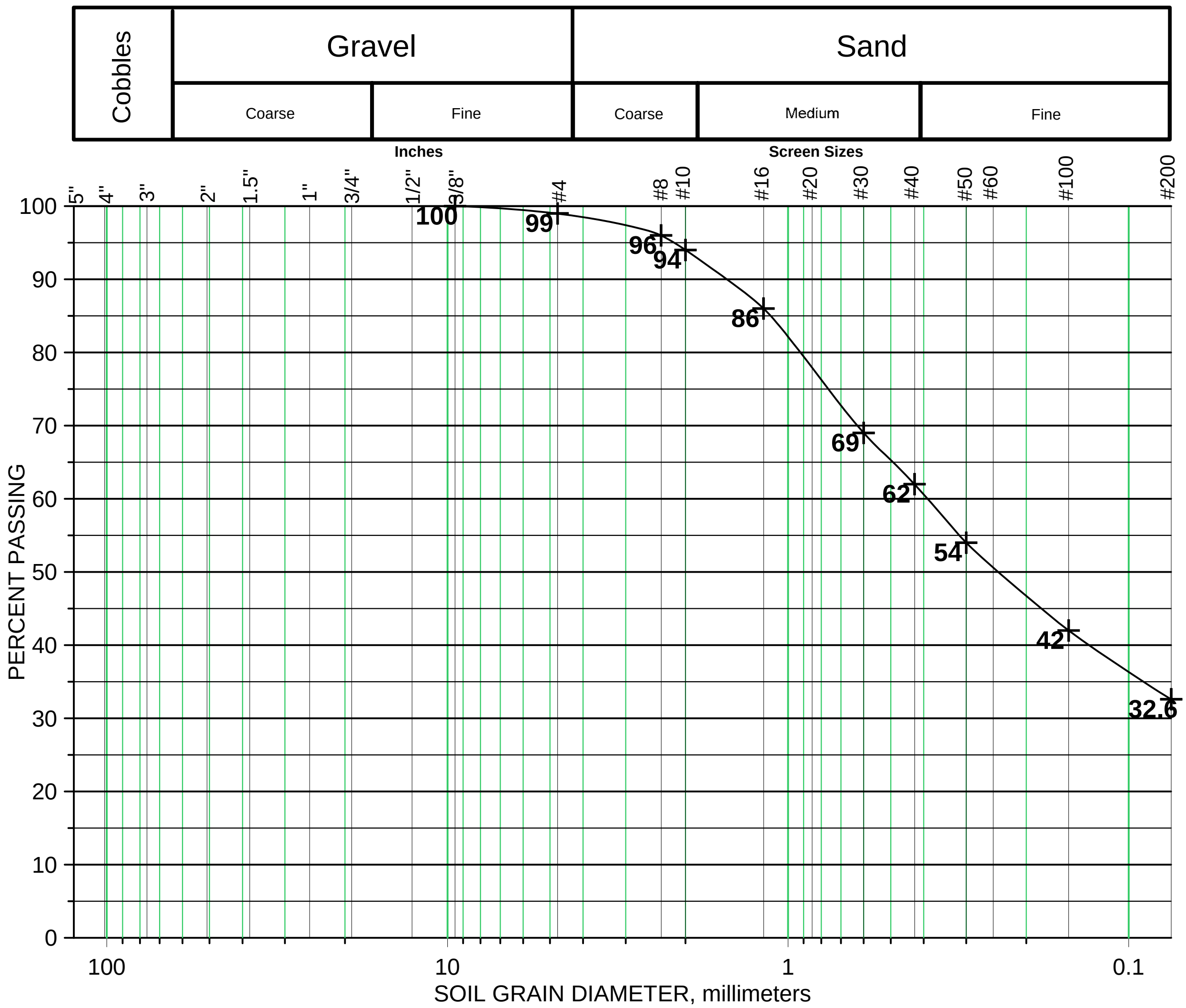
Table A1. Summary of Atterberg Limits, Pittsmont PZF Rotary-Drilling Samples

Drill Hole ID	Material Type	Depth (ft)	Liquid Limit (LL)	Plasticity Index (PI)	Unified Soil Classification of Fines
PZF13-1	Alluvium	290 – 300	42	24	CL
PZF13-1	Alluvium	300 – 310	41	25	CL
PZF13-1	Alluvium	310 – 320	42	26	CL
PZF13-1	Alluvium	320 – 330	46	28	CL
PZF13-1	Alluvium	330 – 340	43	24	CL
PZF13-1	Alluvium	430 – 440	54	39	CH
PZF13-1	Alluvium	460 – 470	24	7	CL/ML
PZF13-1	Alluvium	470 – 480	25	4	CL/ML
PZF13-1	Alluvium	480 – 490	26	3	ML
PZF13-1	Alluvium	490 – 500	26	4	CL/ML
PZF14-1A	Alluvium	150 – 160	37	20	CL
PZF14-1A	Alluvium	170 – 180	37	21	CL
PZF14-1A	Alluvium	180 – 190	41	23	CL
PZF14-1A	Alluvium	190 – 200	43	21	CL
PZF14-1A	Alluvium	200 – 210	40	20	CL
PZF14-1A	Alluvium	340 – 350	NP[1]	NP	ML

[1] Non-plastic

GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079F
Material Source: PZF 13-1, 340 to 350 feet
Sample Classification: -
Date Sampled: -



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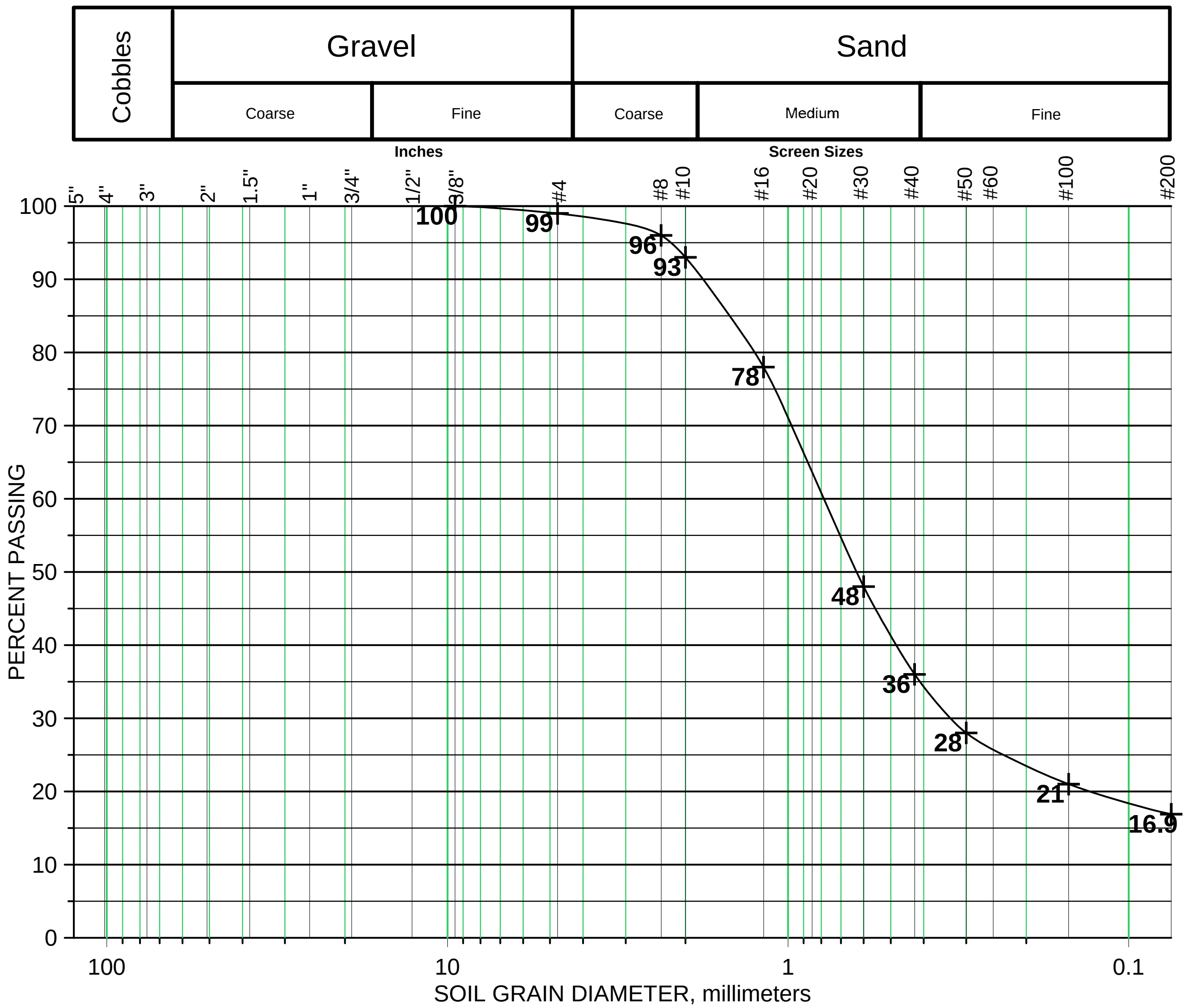
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079G
Material Source: PZF 13-1, 350 to 360 feet
Sample Classification: -
Date Sampled: -



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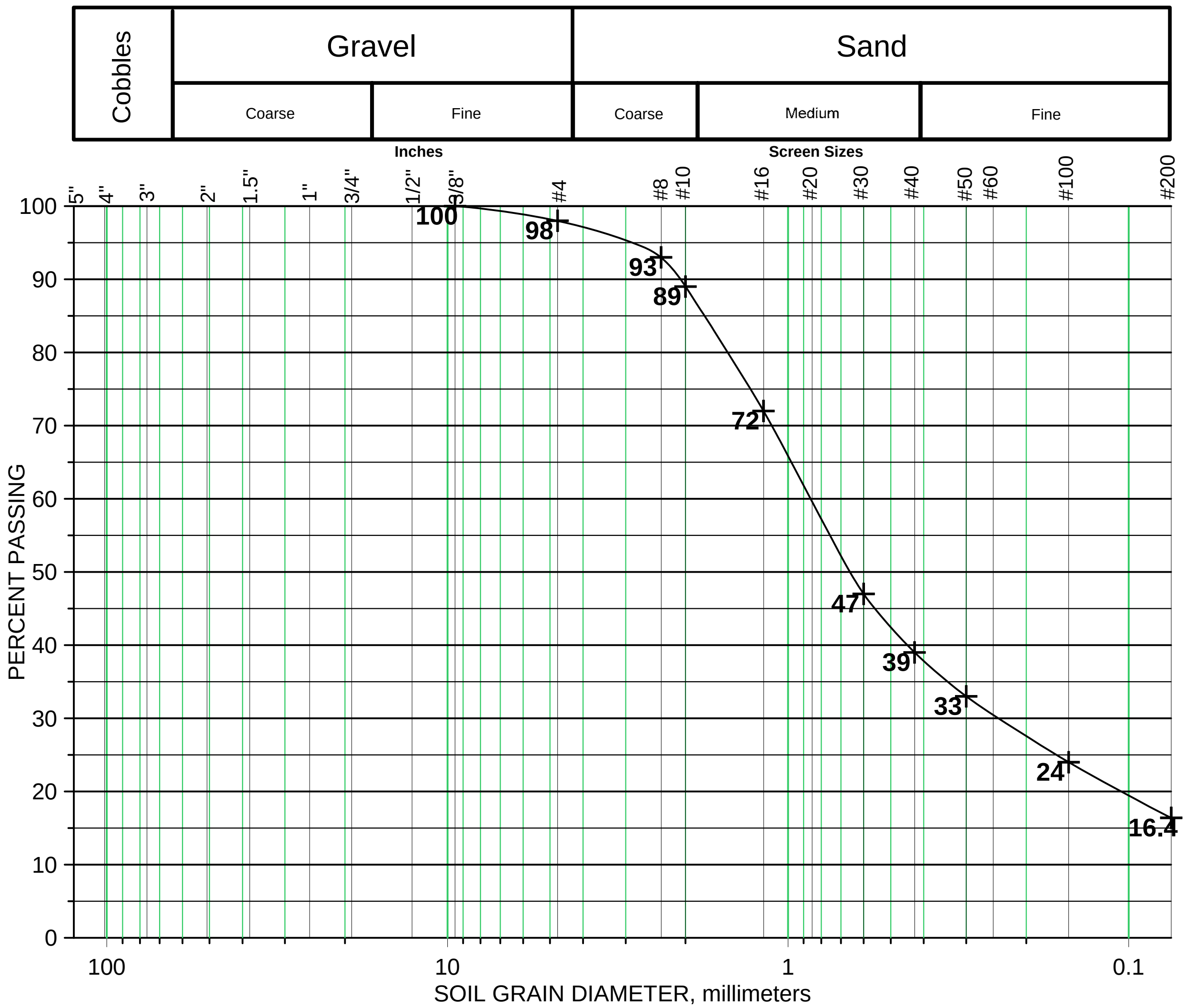
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079H
Material Source: PZF 13-1, 360 to 370 feet
Sample Classification: -
Date Sampled: -



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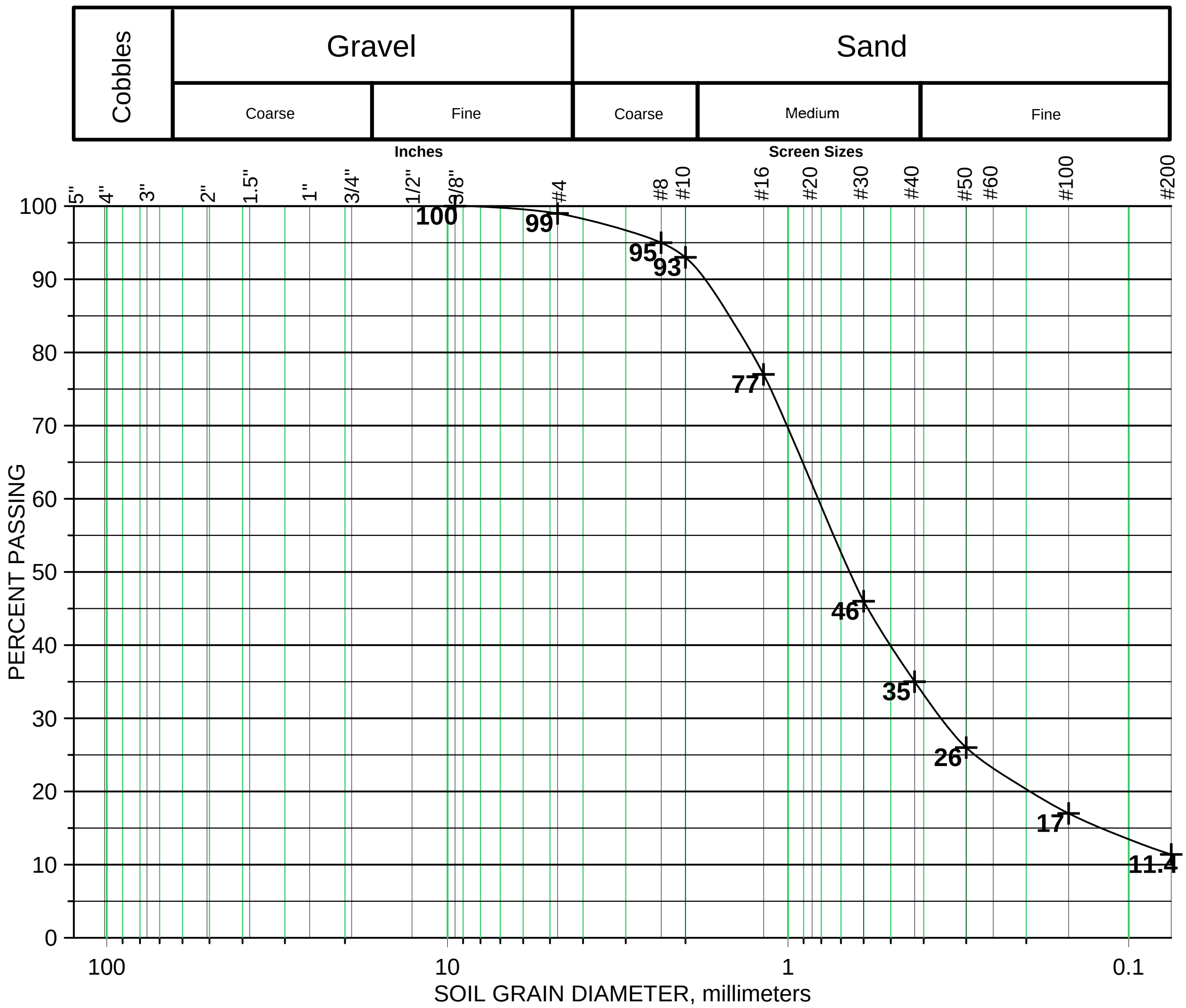
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079I
Material Source: PZF 13-1, 370 to 380 feet
Sample Classification: -
Date Sampled: -



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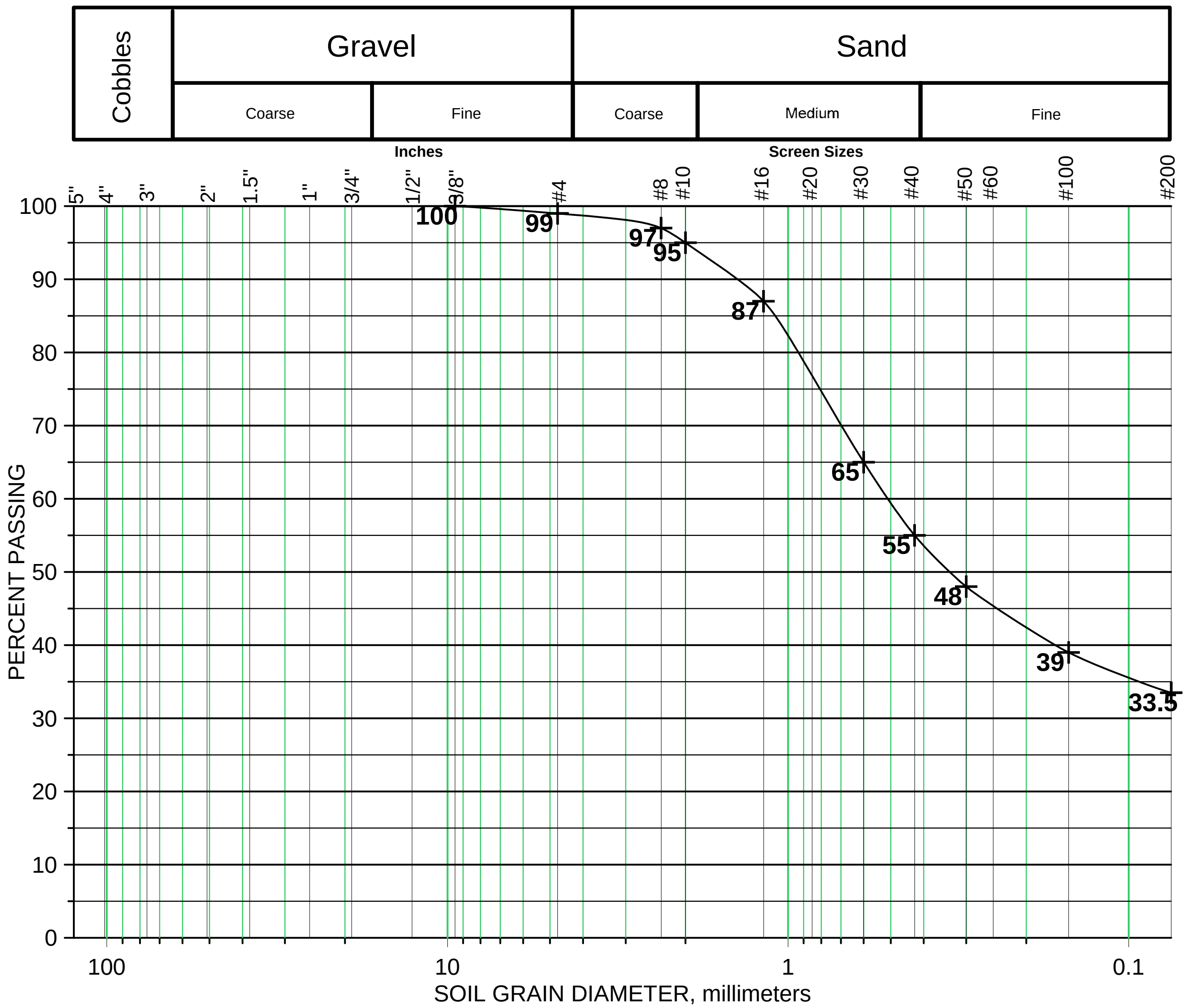
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079J
Material Source: PZF 13-1, 380 to 390 feet
Sample Classification: -
Date Sampled: -



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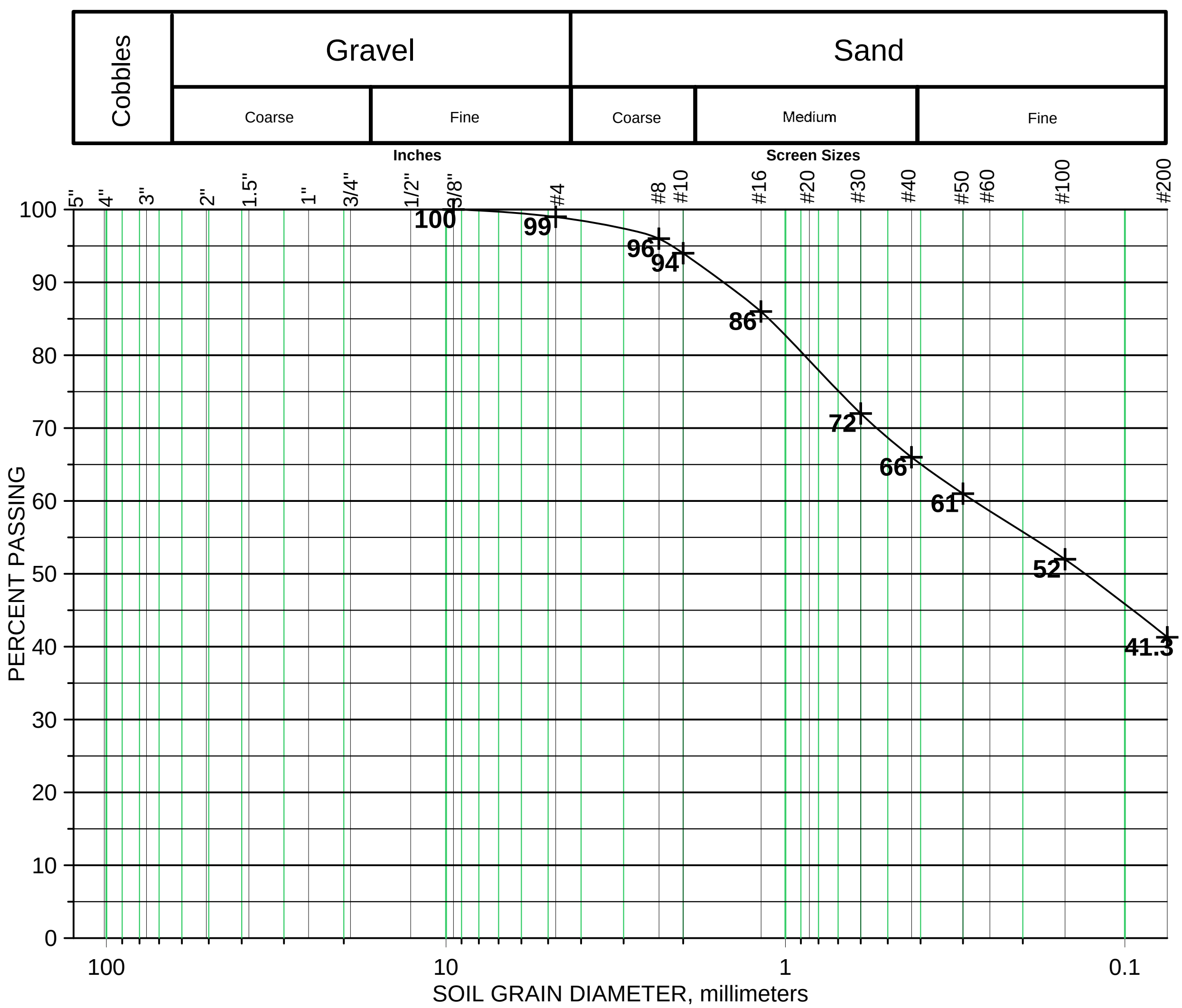
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079K
Material Source: PZF 13-1, 390 to 400 feet
Sample Classification: -
Date Sampled: -



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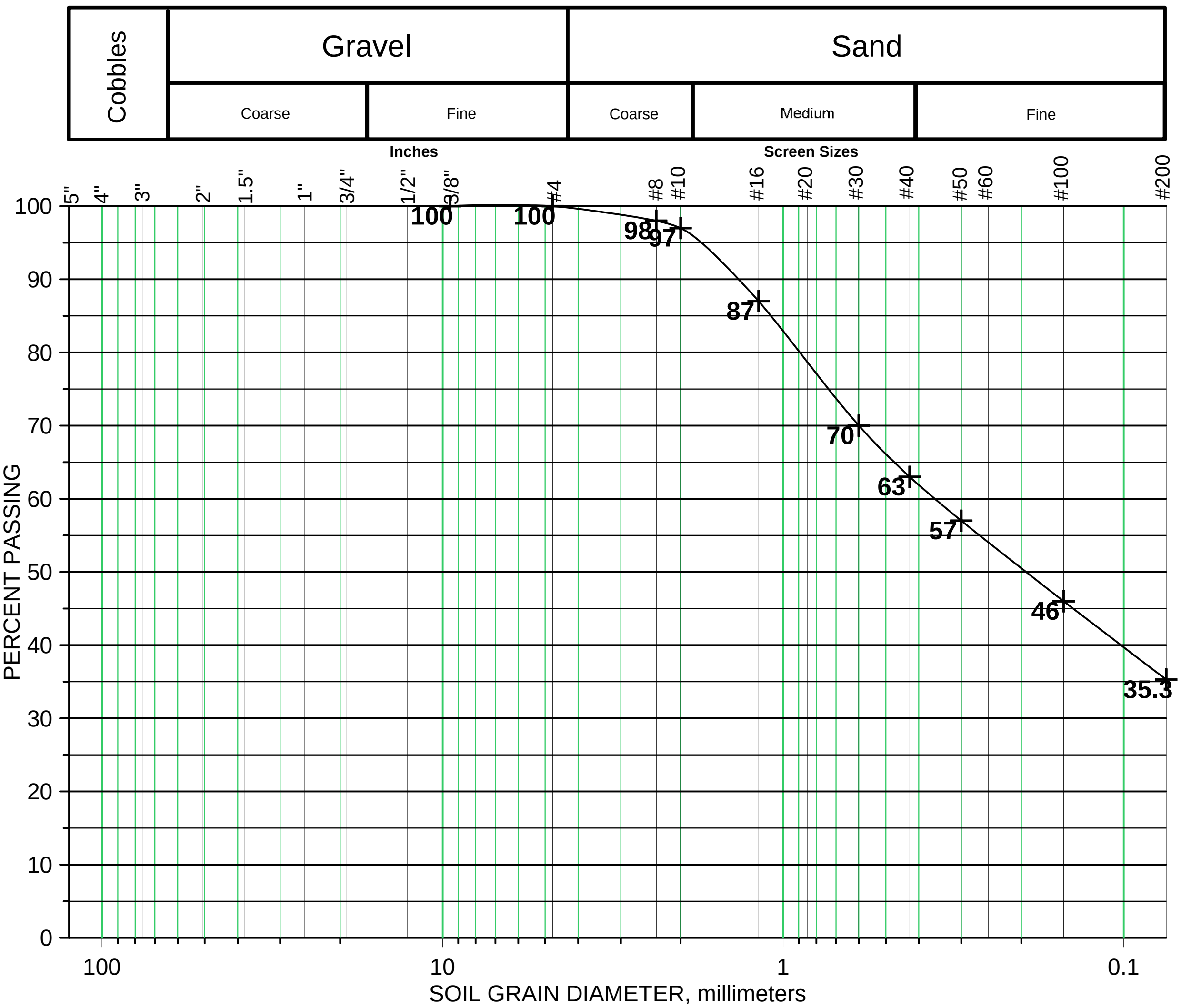
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079L
Material Source: PZF 13-1, 400 to 410 feet
Sample Classification: -
Date Sampled: -



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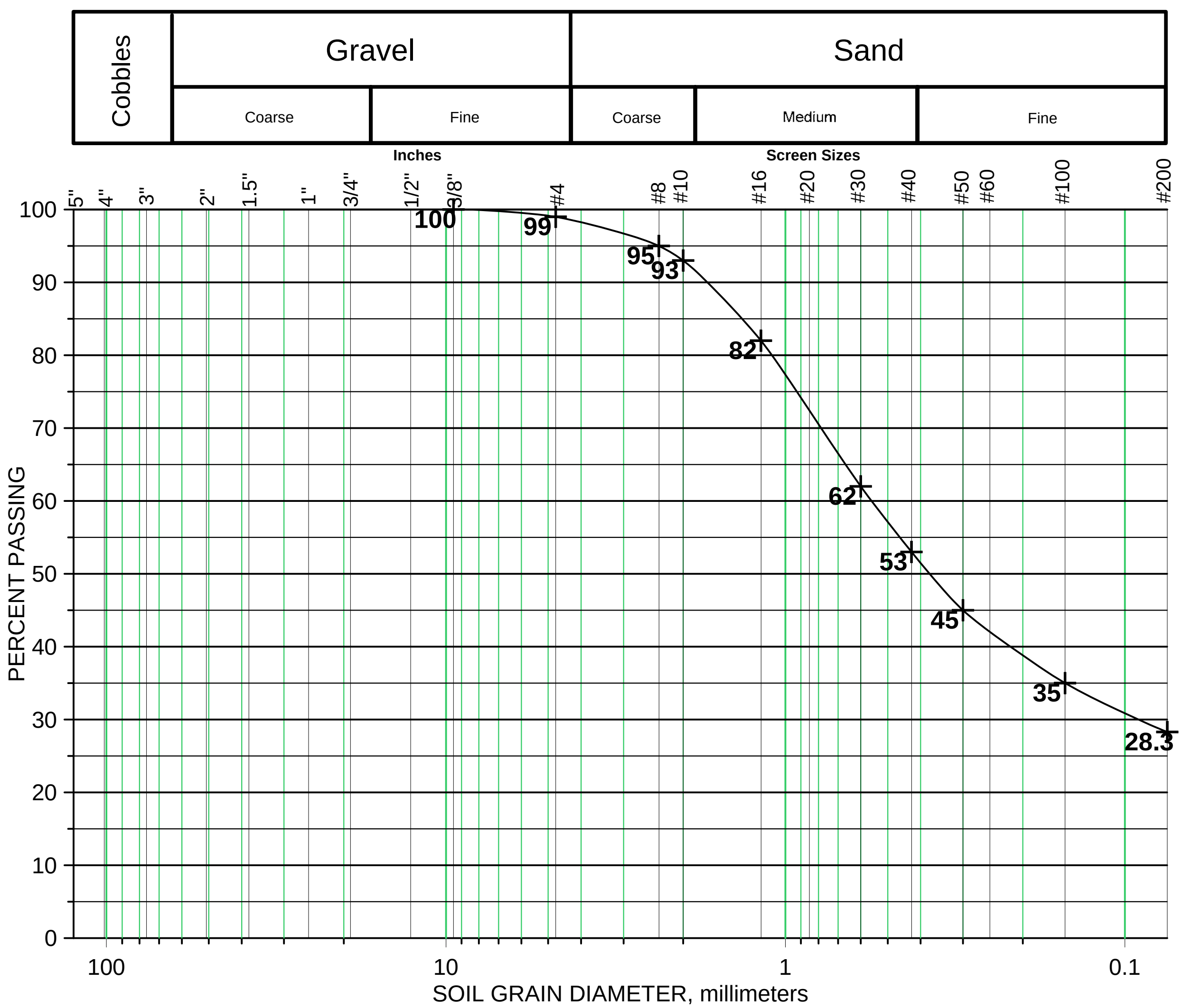
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079M
Material Source: PZF 13-1, 420 to 430 feet
Sample Classification: -
Date Sampled: -



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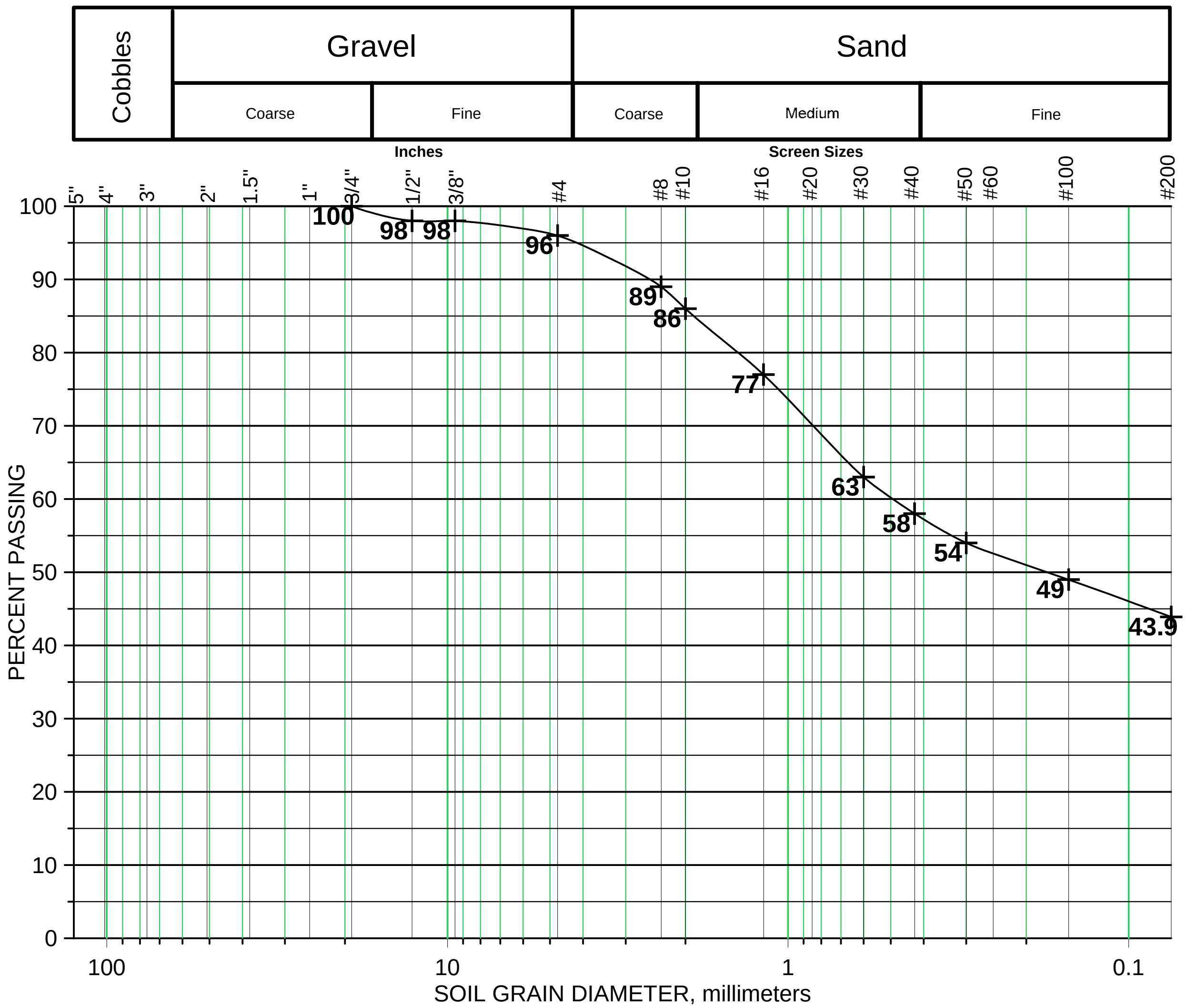
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI14000790
Material Source: PZF 13-1, 440 to 450 feet
Sample Classification: -
Date Sampled: -



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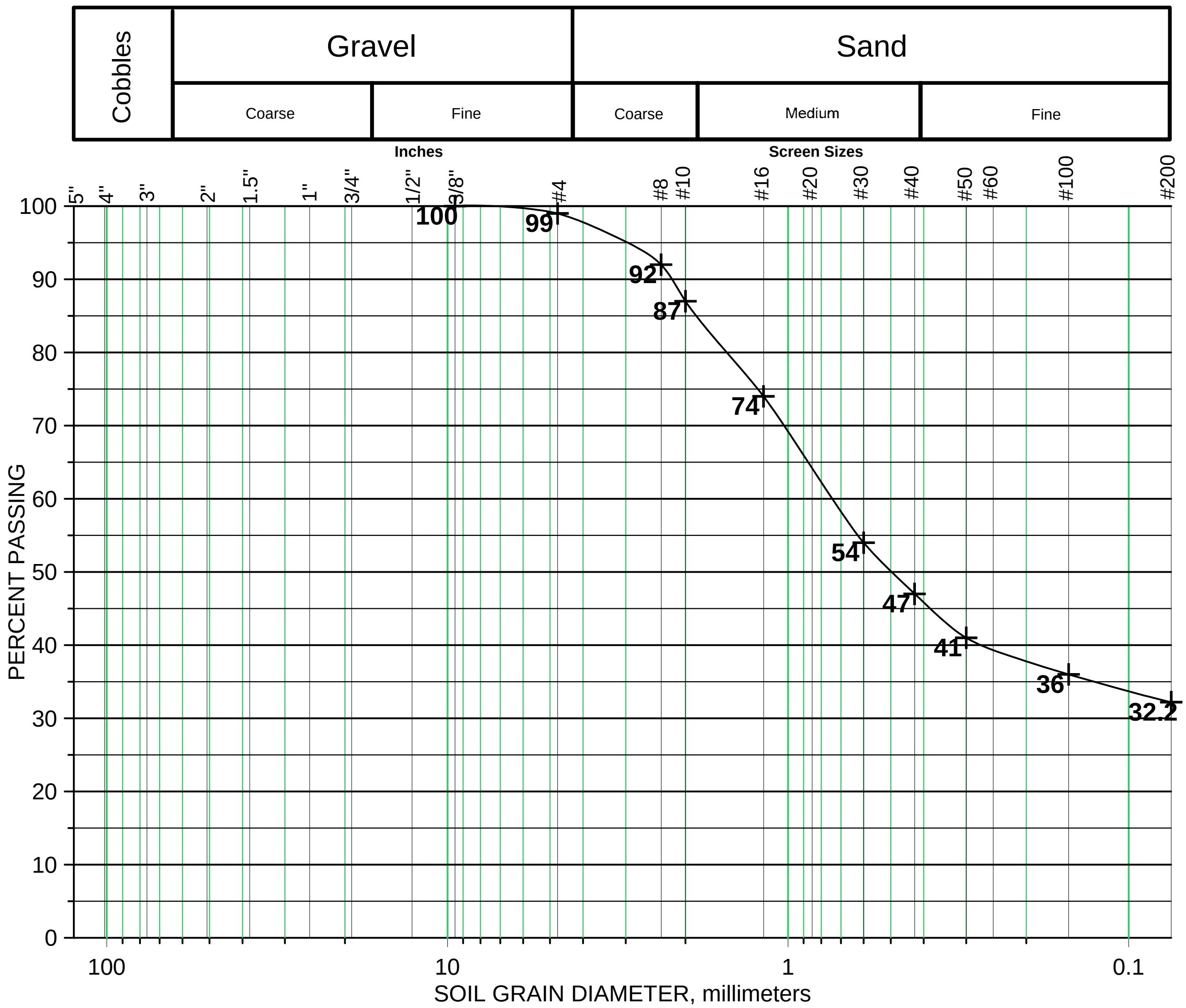
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079P
Material Source: PZF 13-1, 450 to 460 feet
Sample Classification: -
Date Sampled: -



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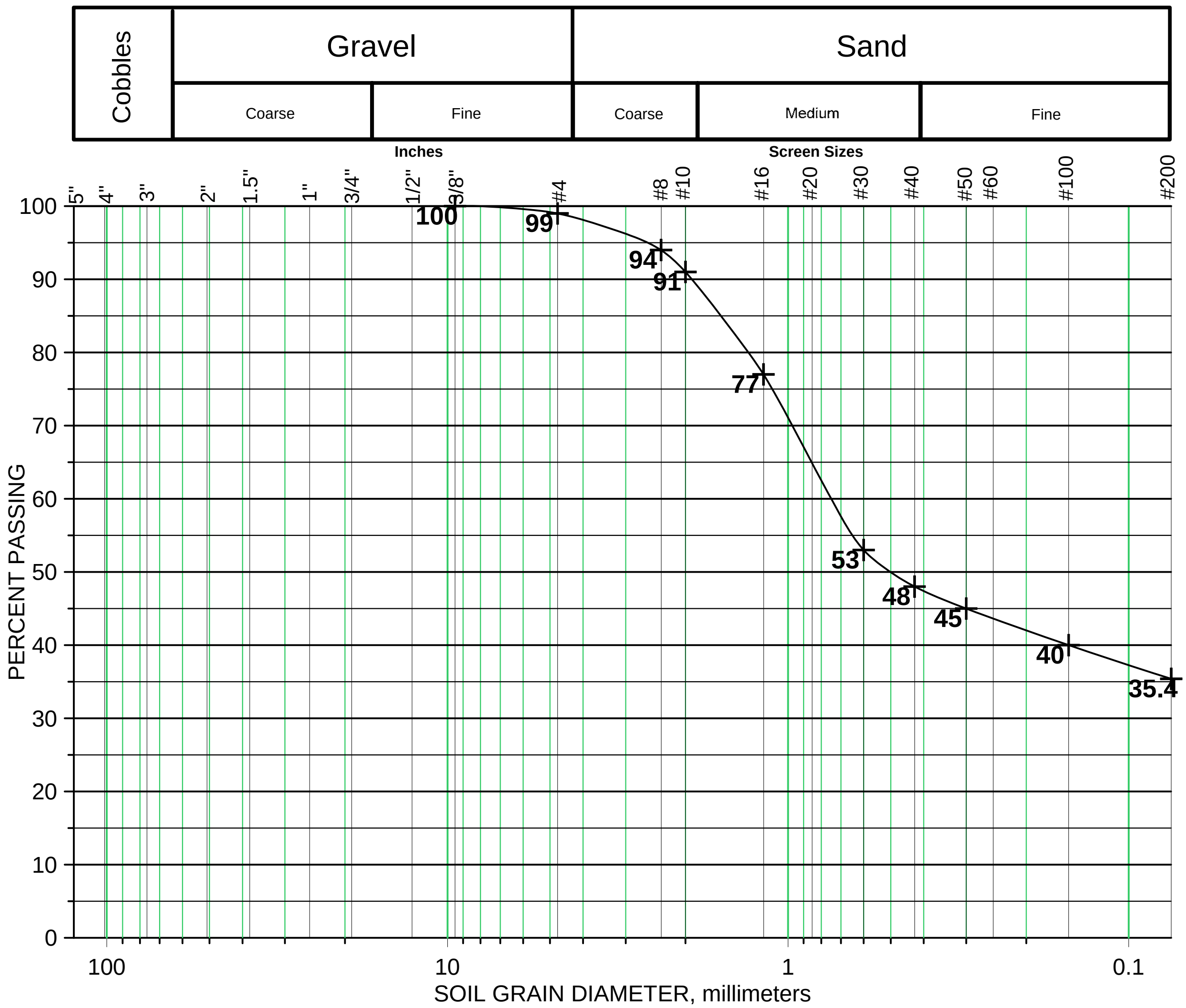
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400079S
Material Source: PZF 13-1, 480 to 490 feet
Sample Classification: -
Date Sampled: -



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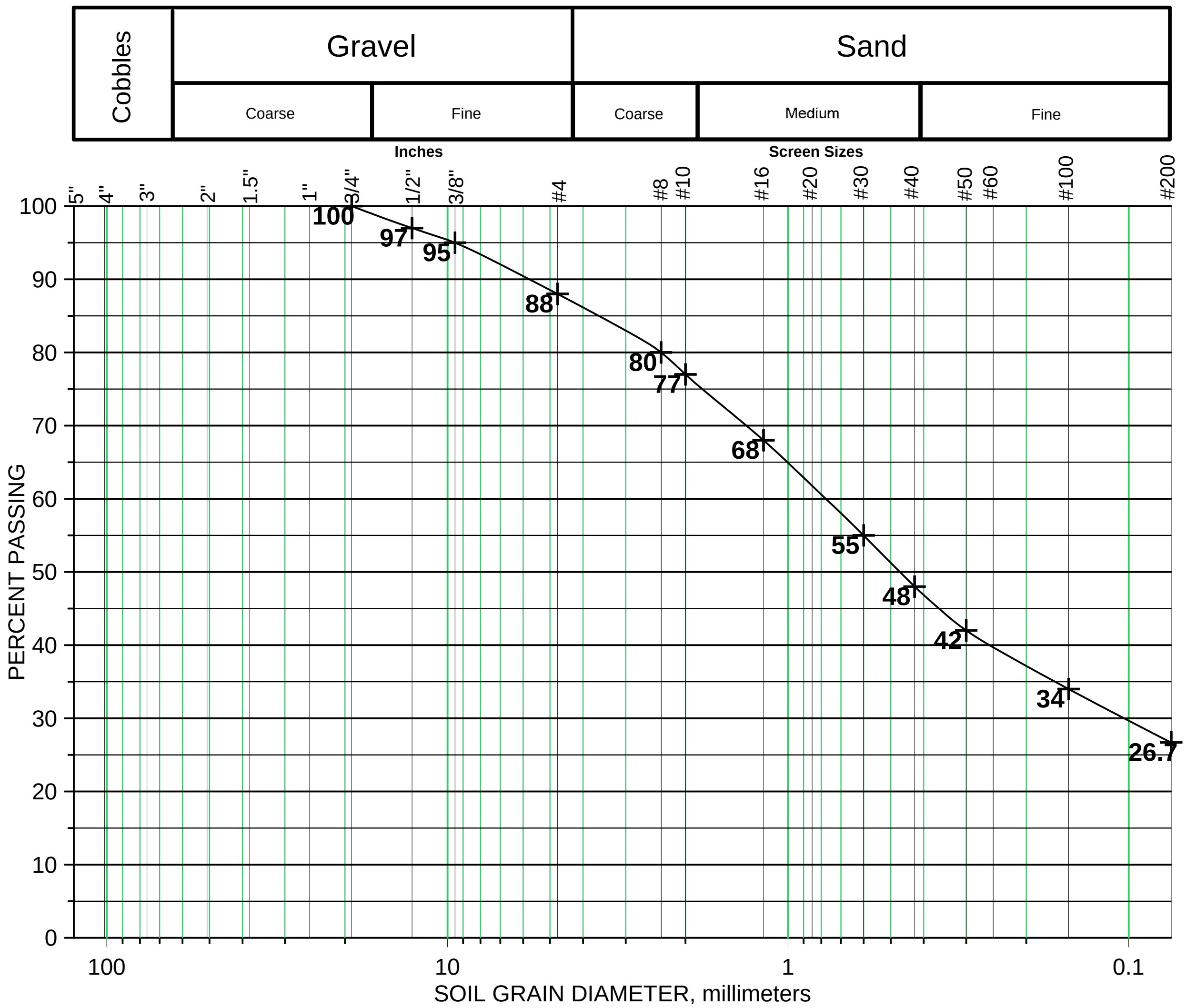
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081A
Material Source: PZF 14-1A, 0 to 10 feet
Sample Classification: -
Date Sampled: -



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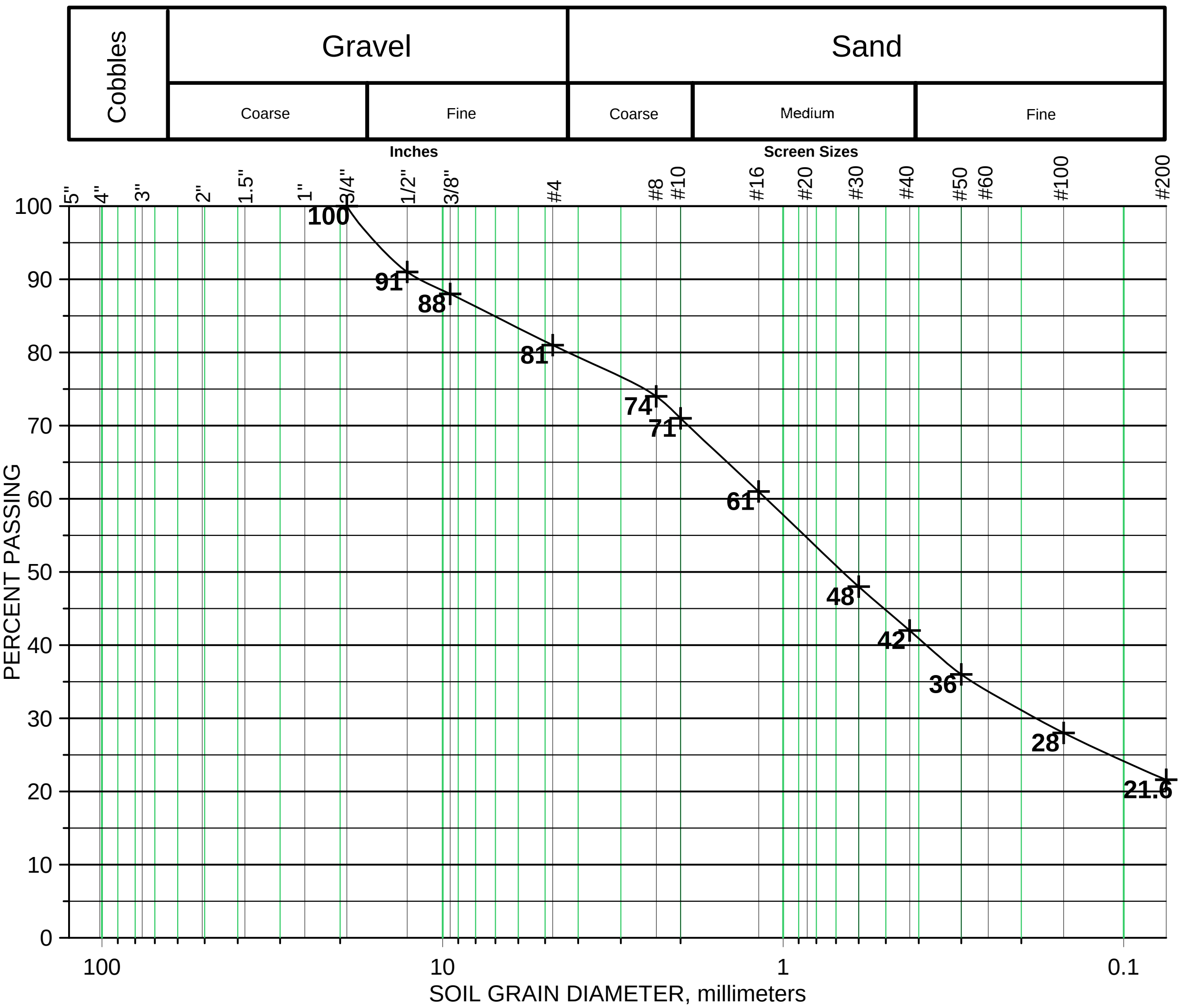
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081B
Material Source: PZF 14-1A, 10 to 20 feet
Sample Classification: -
Date Sampled: -



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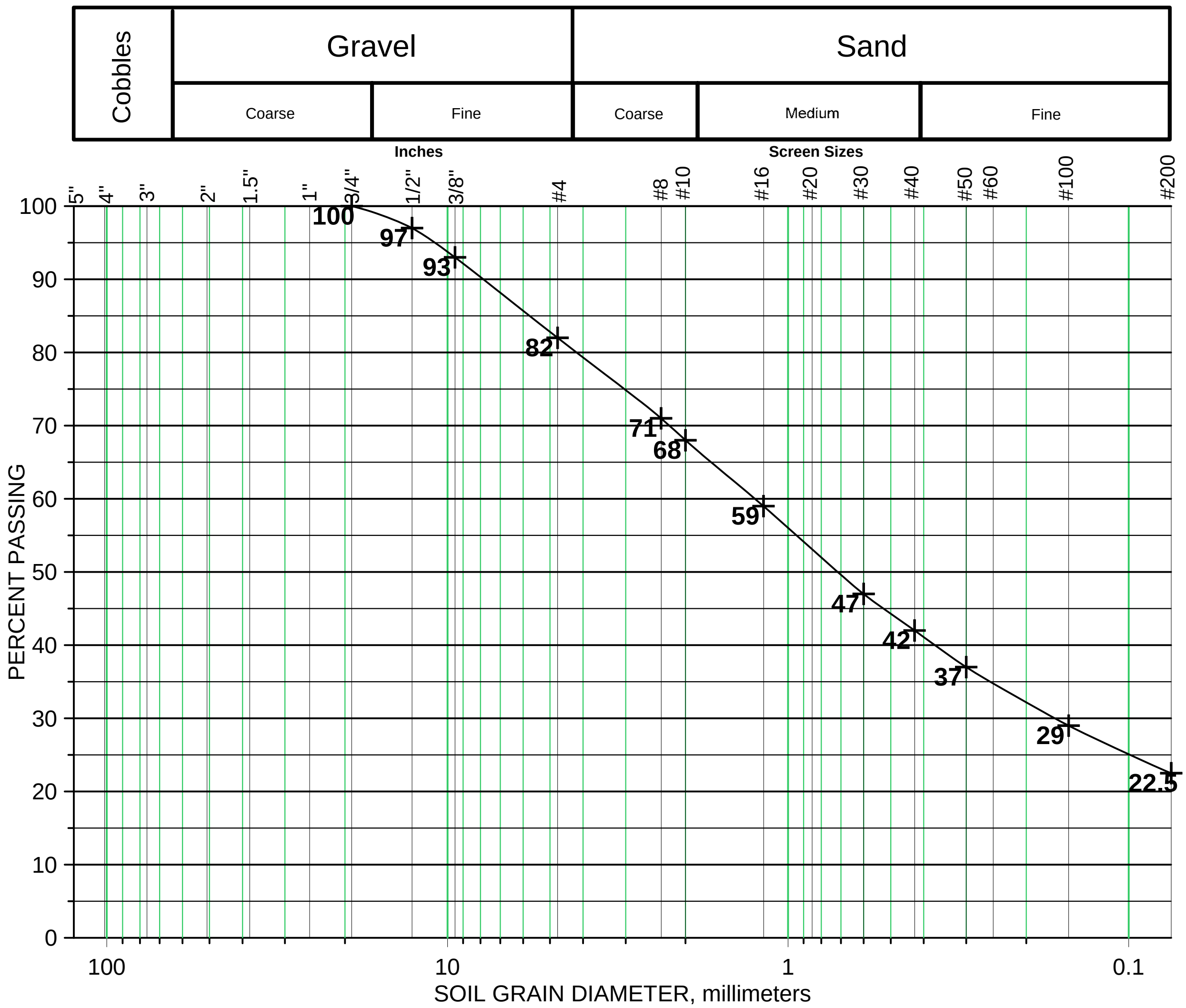
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081C
Material Source: PZF 14-1A, 20 to 30 feet
Sample Classification: -
Date Sampled: -



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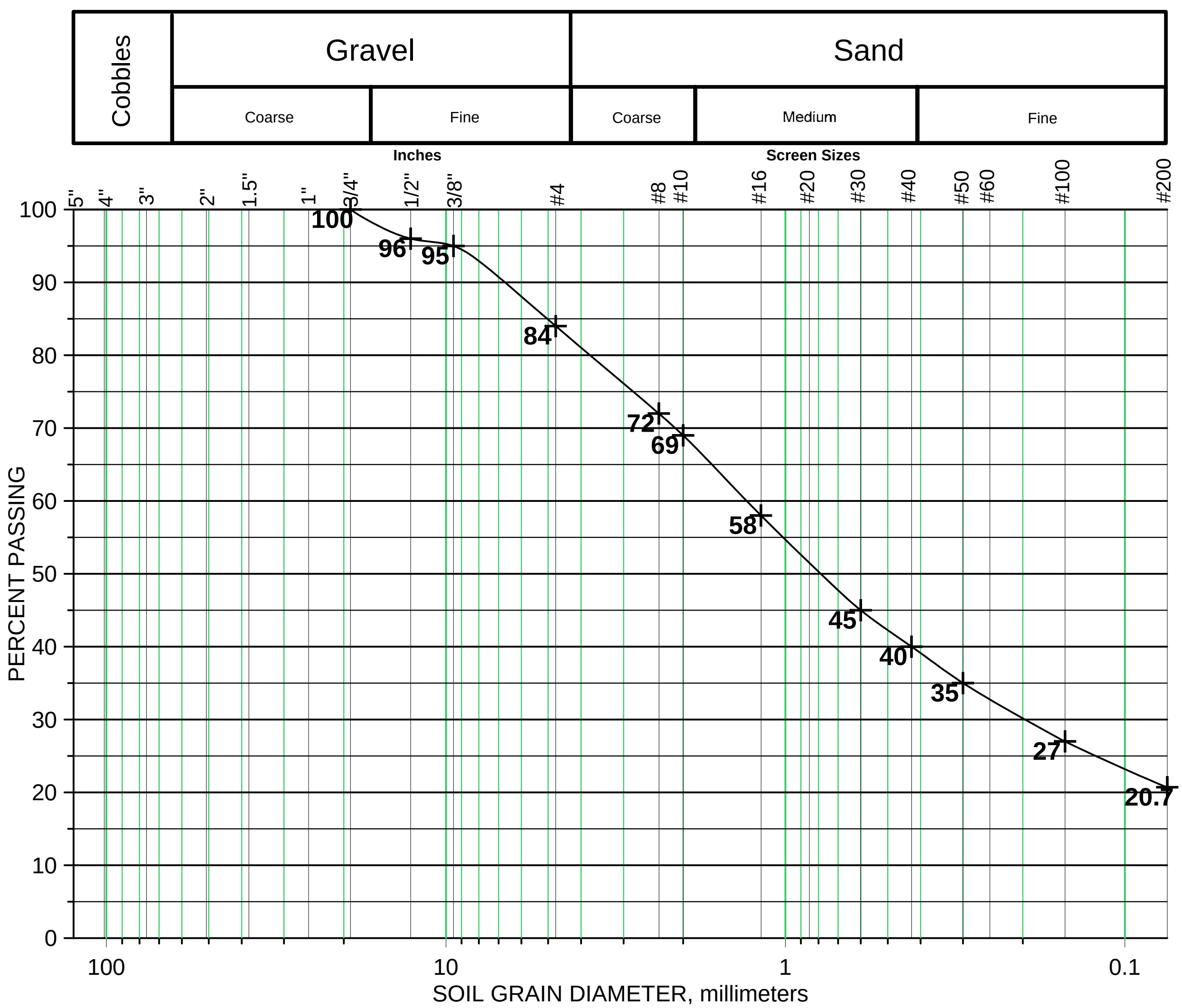
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081D
Material Source: PZF 14-1A, 30 to 40 feet
Sample Classification: -
Date Sampled: -



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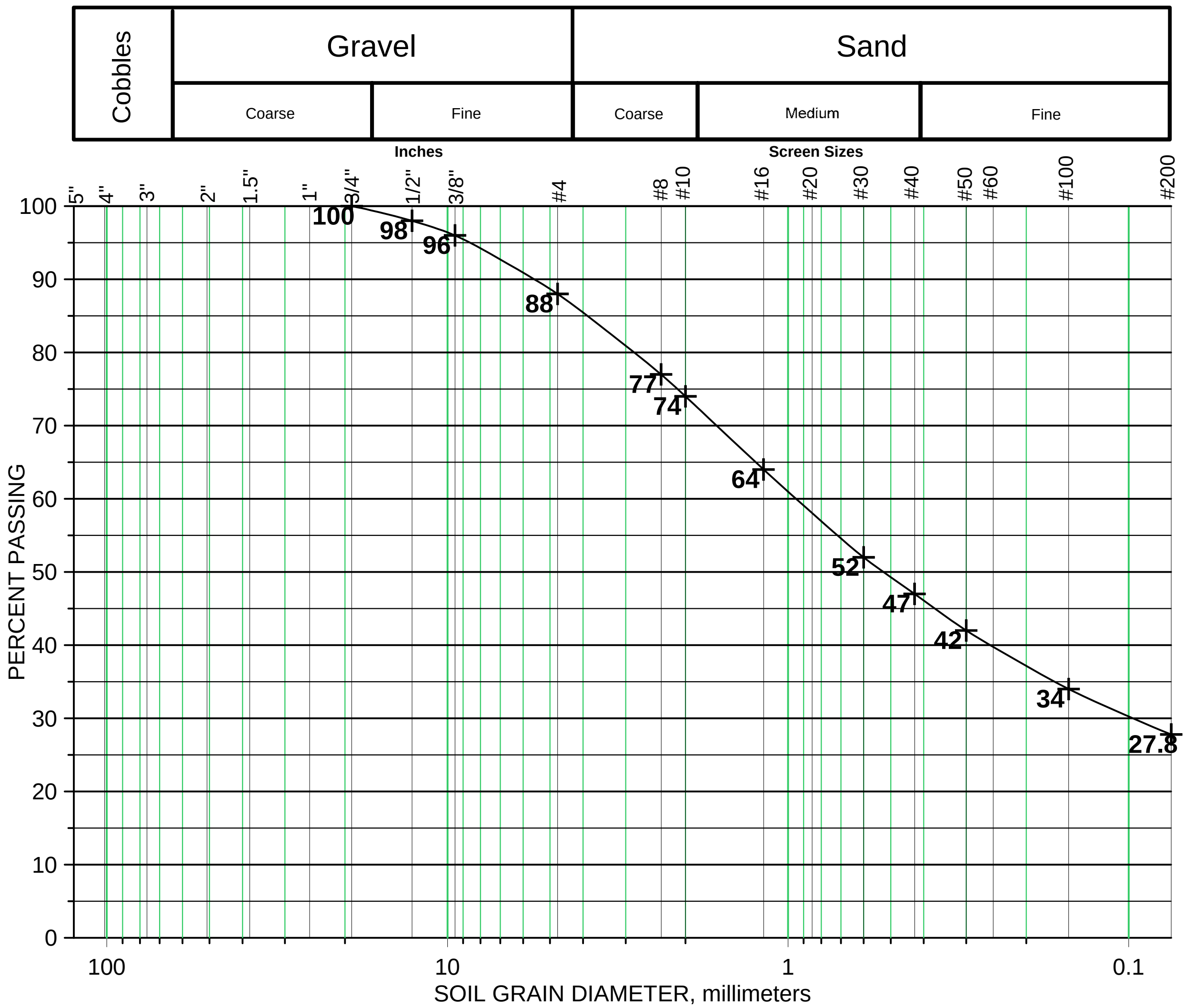
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081E
Material Source: PZF 14-1A, 40 to 50 feet
Sample Classification: -
Date Sampled: -



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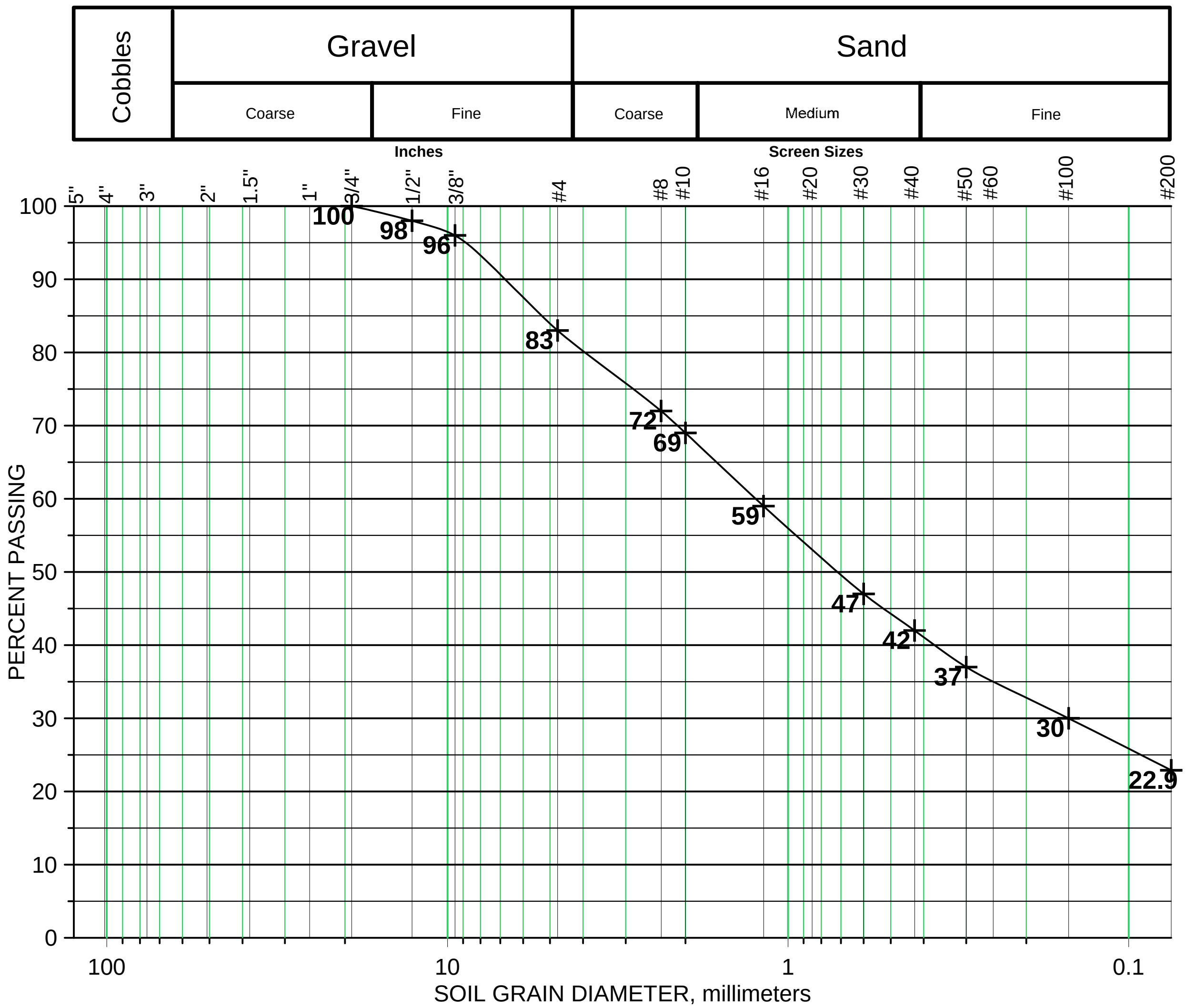
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081F
Material Source: PZF 14-1A, 50 to 60 feet
Sample Classification: -
Date Sampled: -



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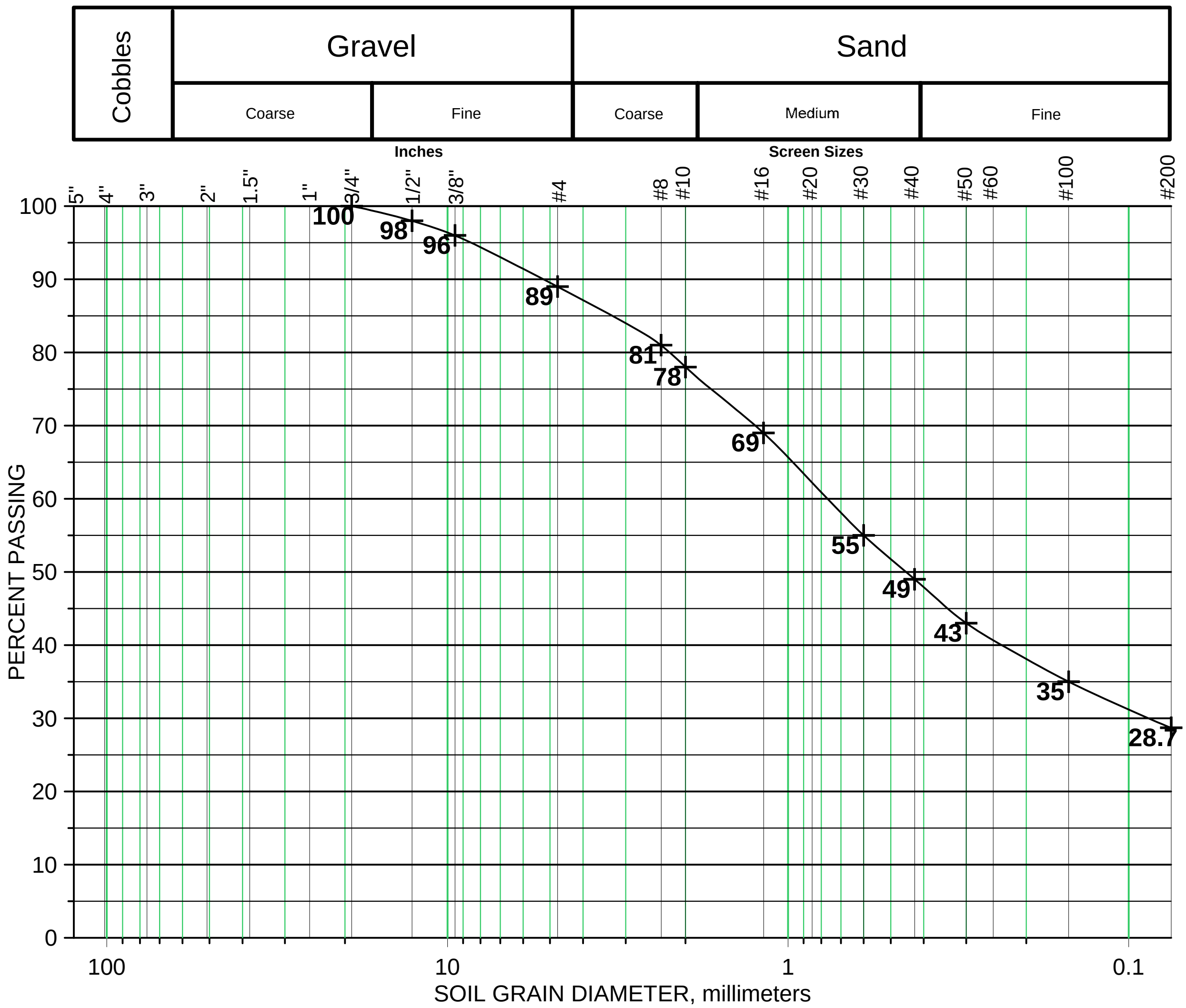
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081G
Material Source: PZF 14-1A, 60 to 70 feet
Sample Classification: -
Date Sampled: -



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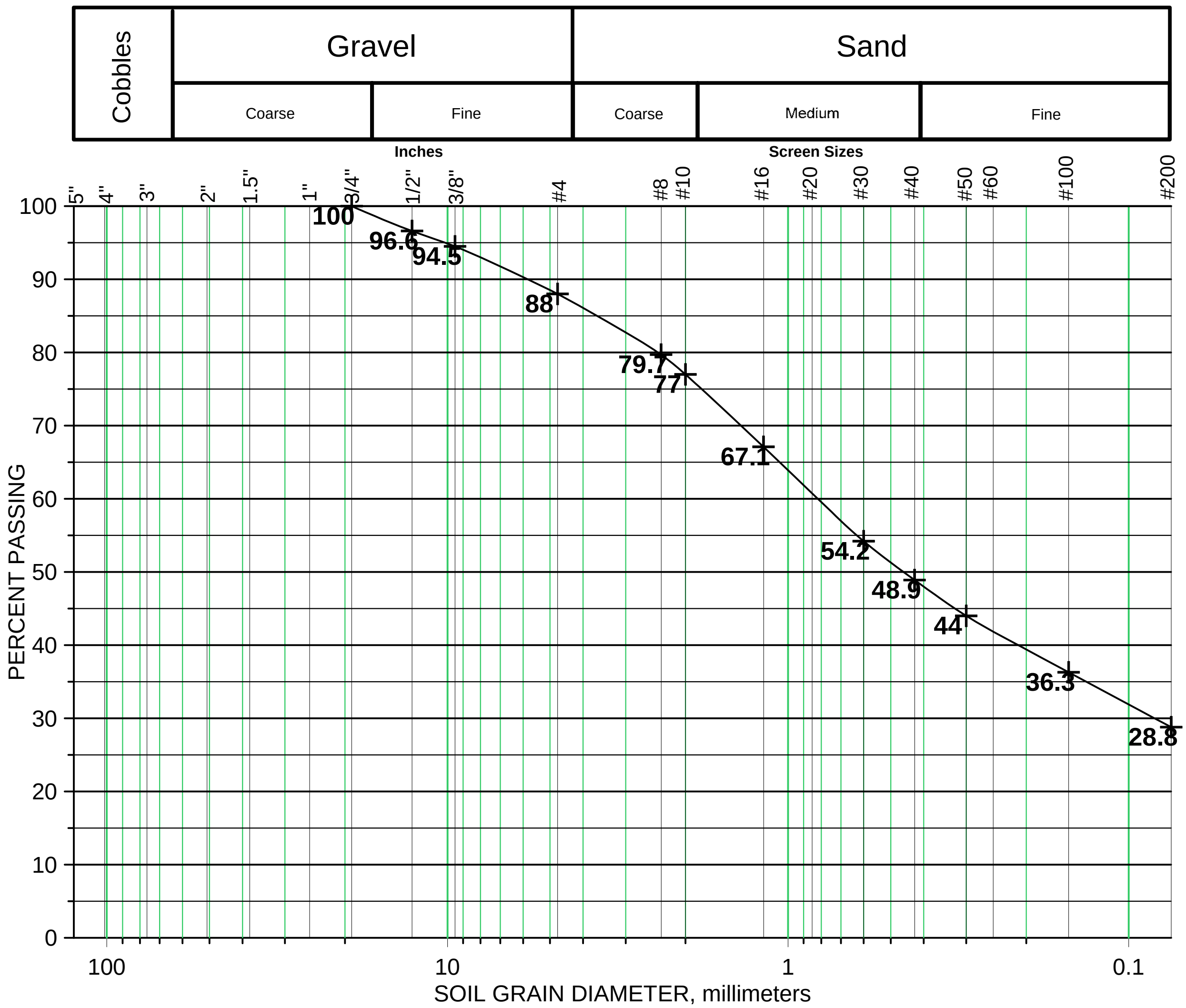
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081H
Material Source: PZF 14-1A, 70 to 80 feet
Sample Classification: -
Date Sampled: -



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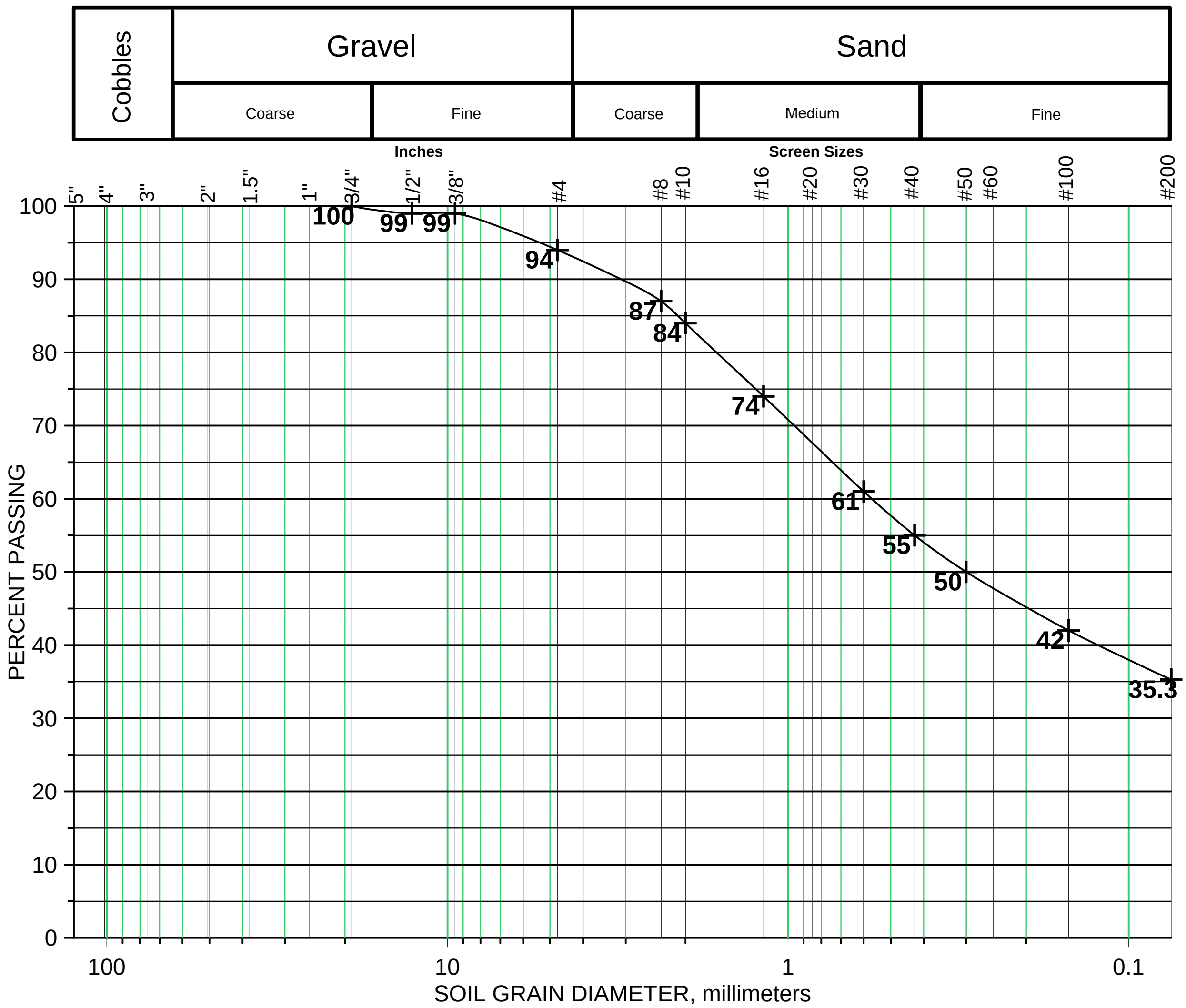
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI14000811
Material Source: PZF 14-1A, 80 to 90 feet
Sample Classification: -
Date Sampled: -



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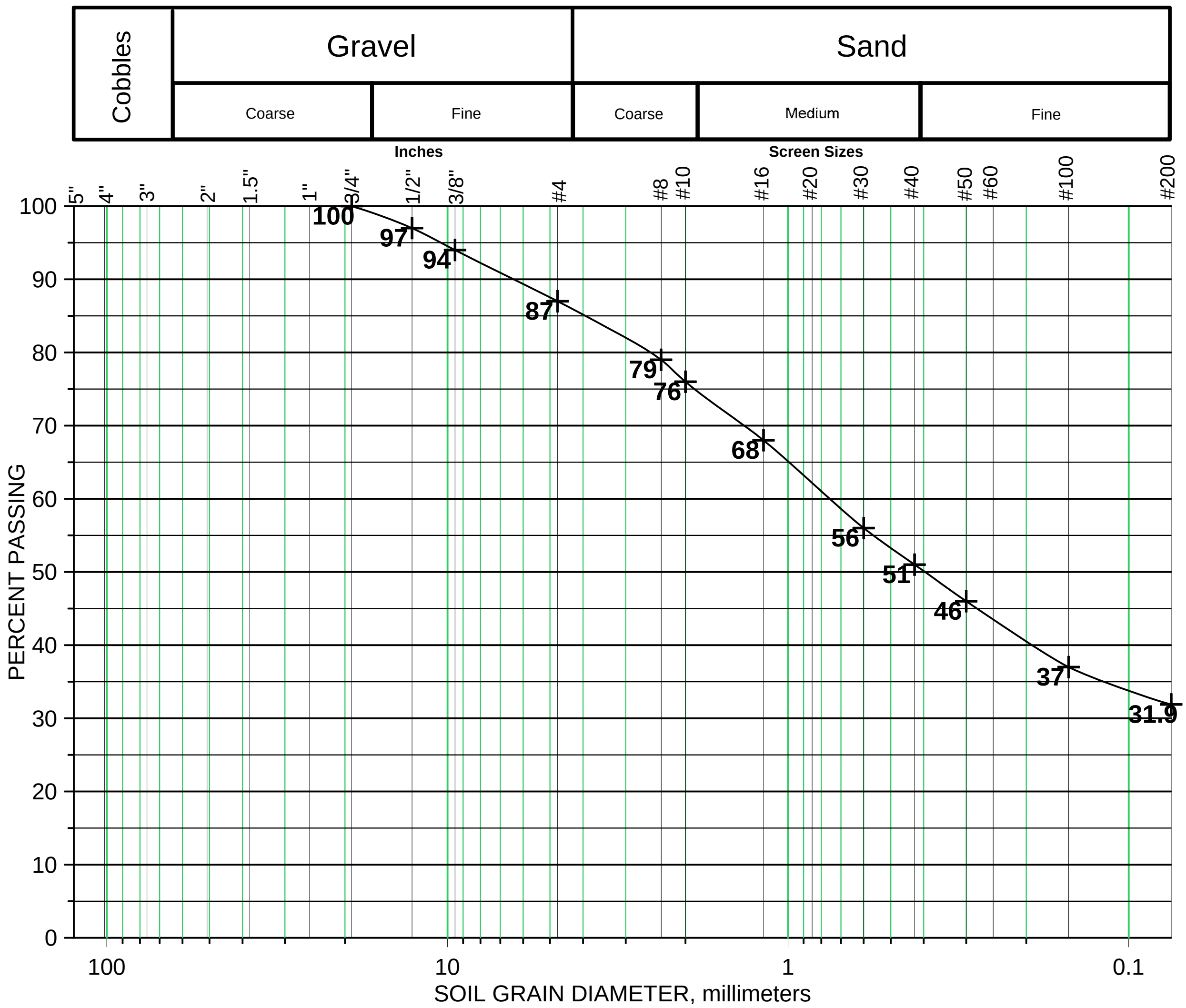
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081J
Material Source: PZF 14-1A, 90 to 100 feet
Sample Classification: -
Date Sampled: -



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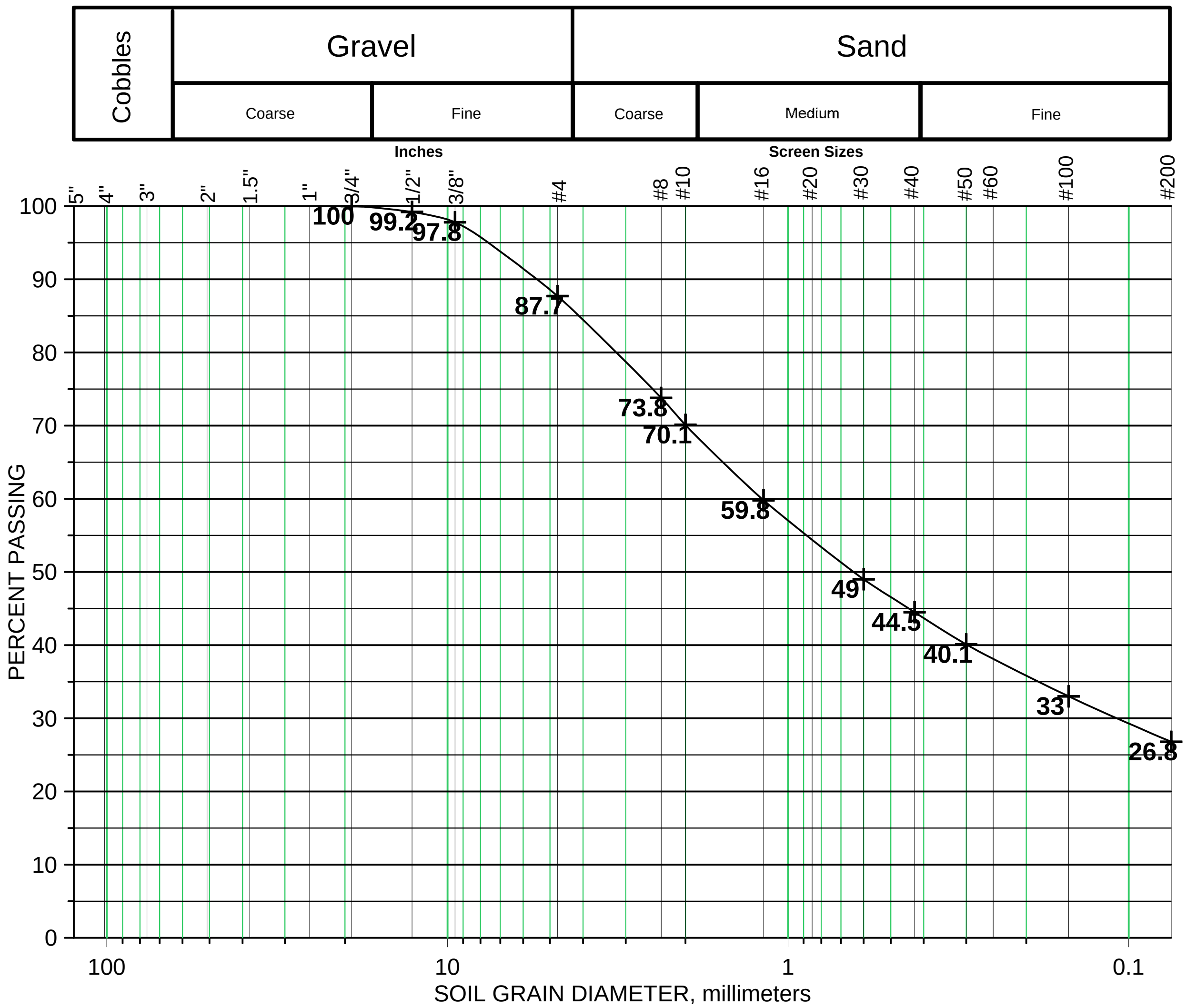
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081K
Material Source: P2F 14-1A, 100 to 110 feet
Sample Classification: -
Date Sampled: -



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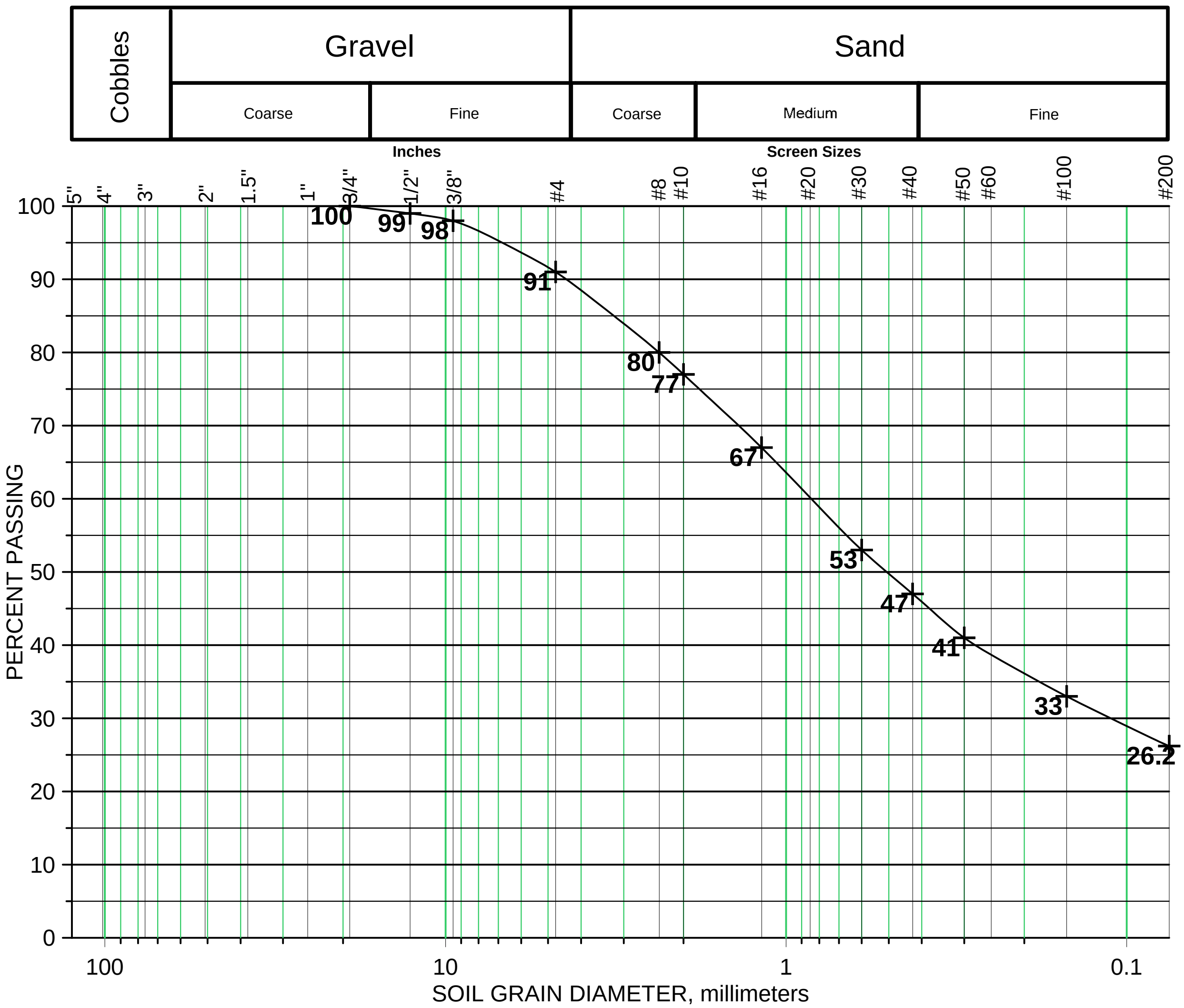
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081L
Material Source: PZF 14-1A, 110 to 120 feet
Sample Classification: -
Date Sampled: -



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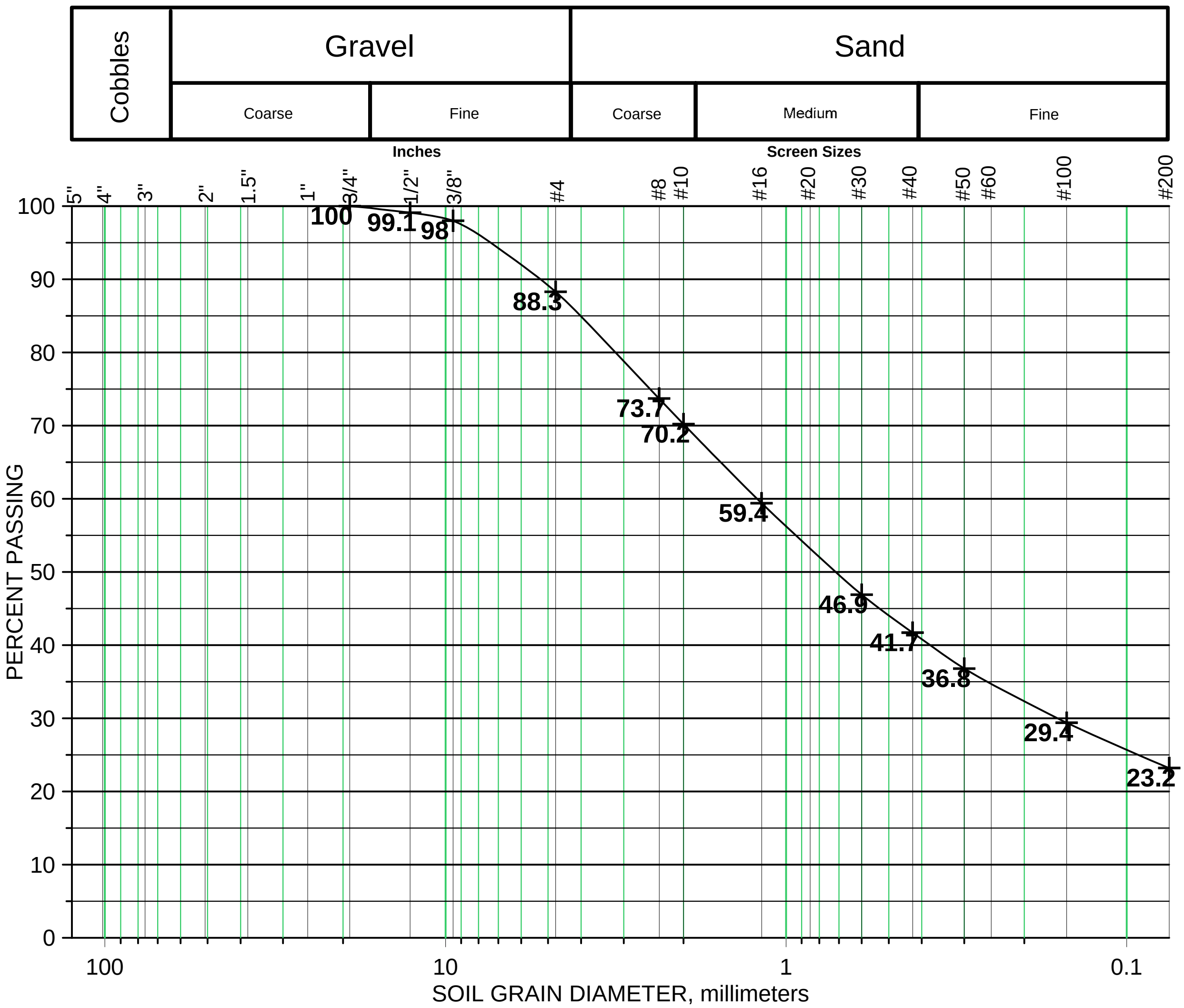
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081M
Material Source: PZF 14-1A, 120 to 130 feet
Sample Classification: -
Date Sampled: -



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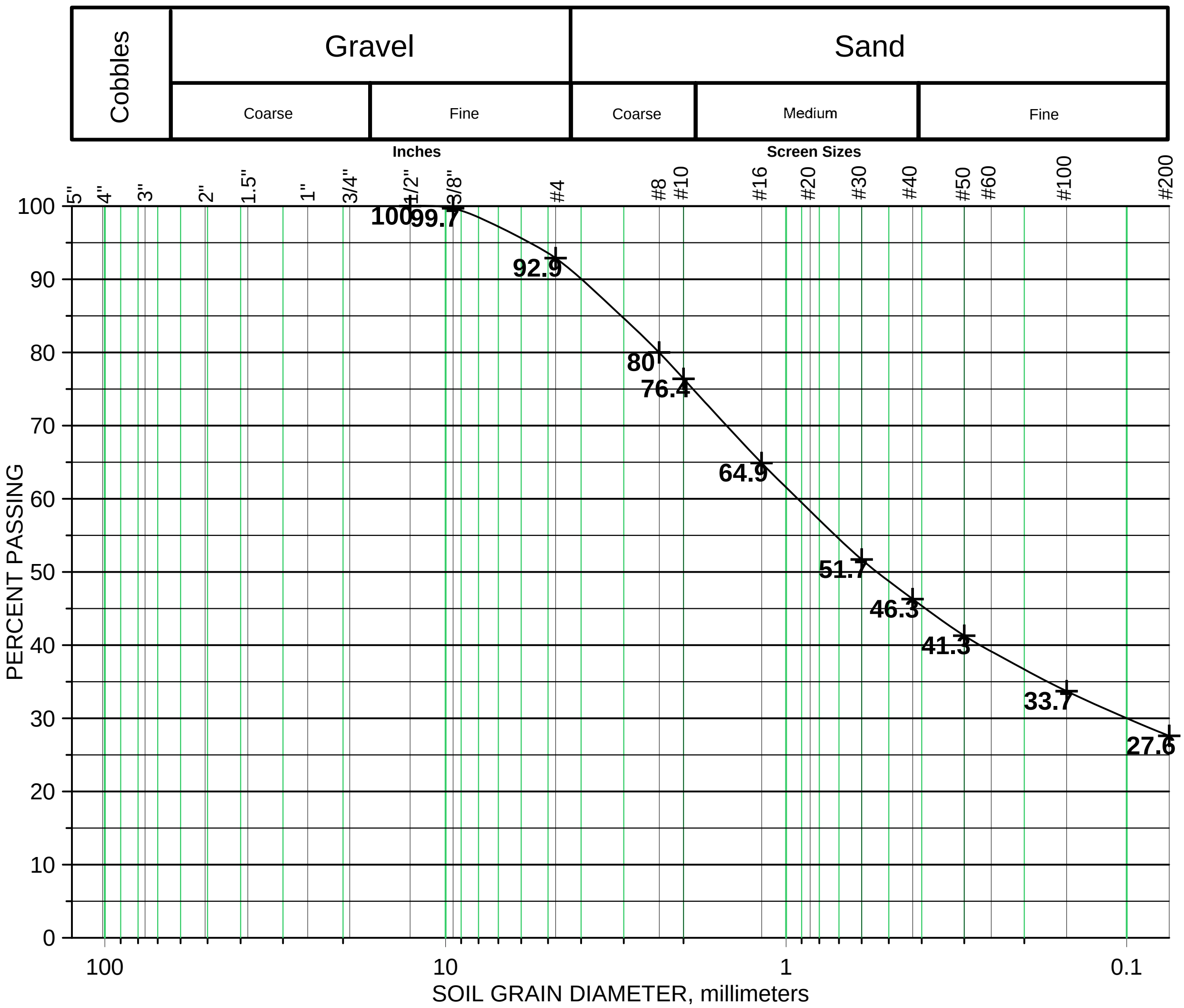
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081N
Material Source: PZF 14-1A, 130 to 140 feet
Sample Classification: -
Date Sampled: -



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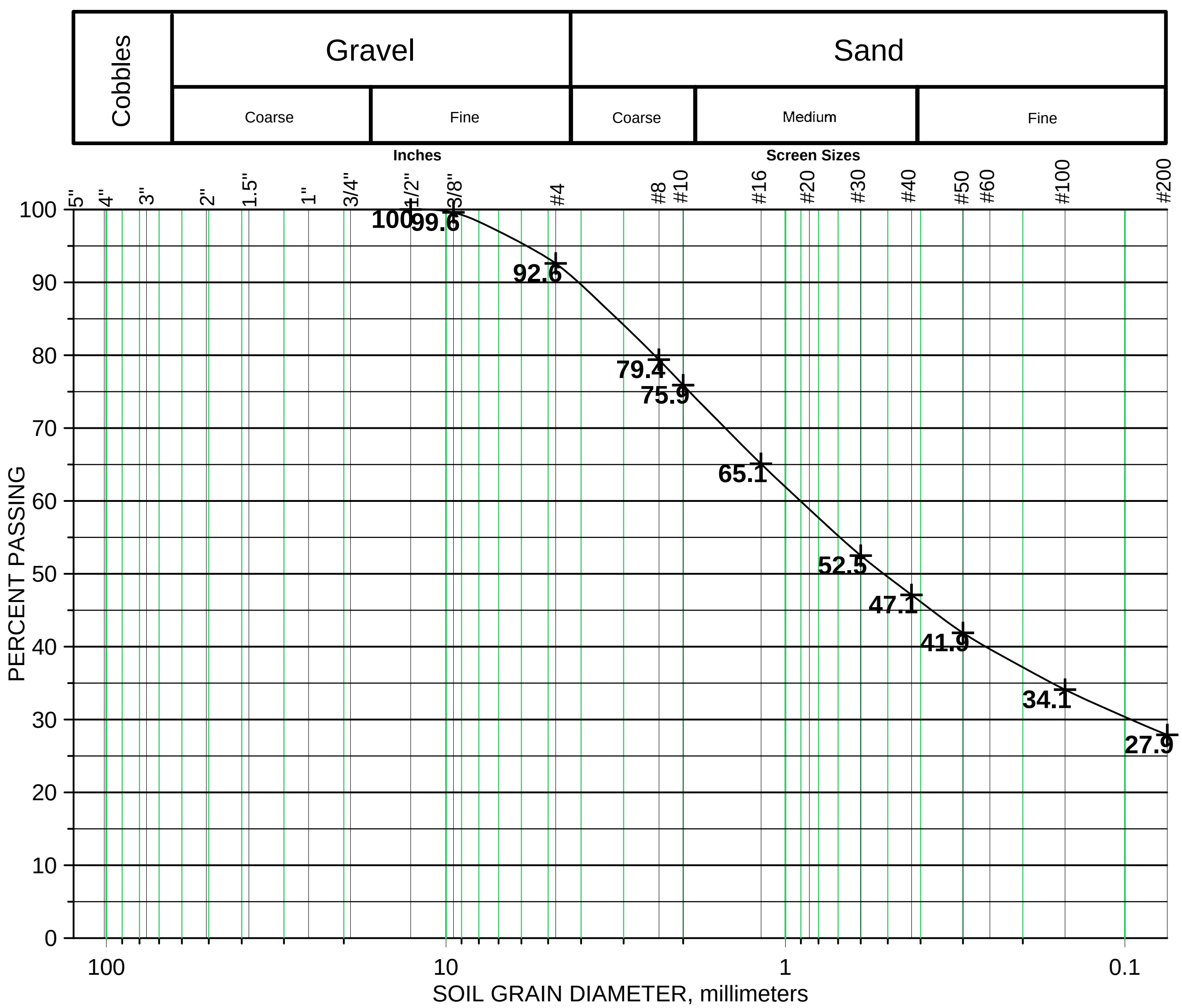
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081O
Material Source: PZF 14-1A, 140 to 150 feet
Sample Classification: -
Date Sampled: -



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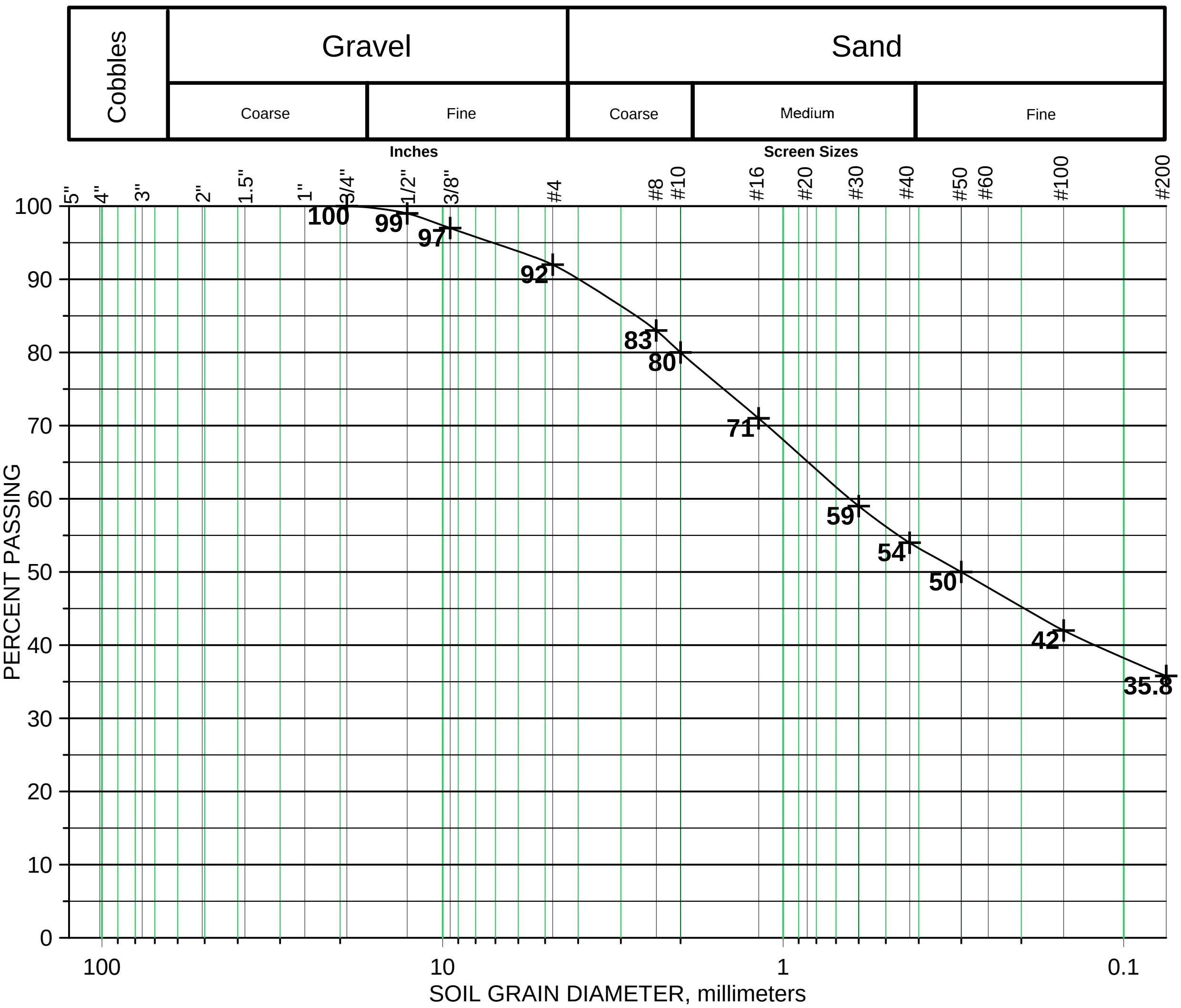
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI14010B
Lab Number: MI1400081P
Material Source: PZF 14-1A, 150 to 160 feet
Sample Classification: -
Date Sampled: -



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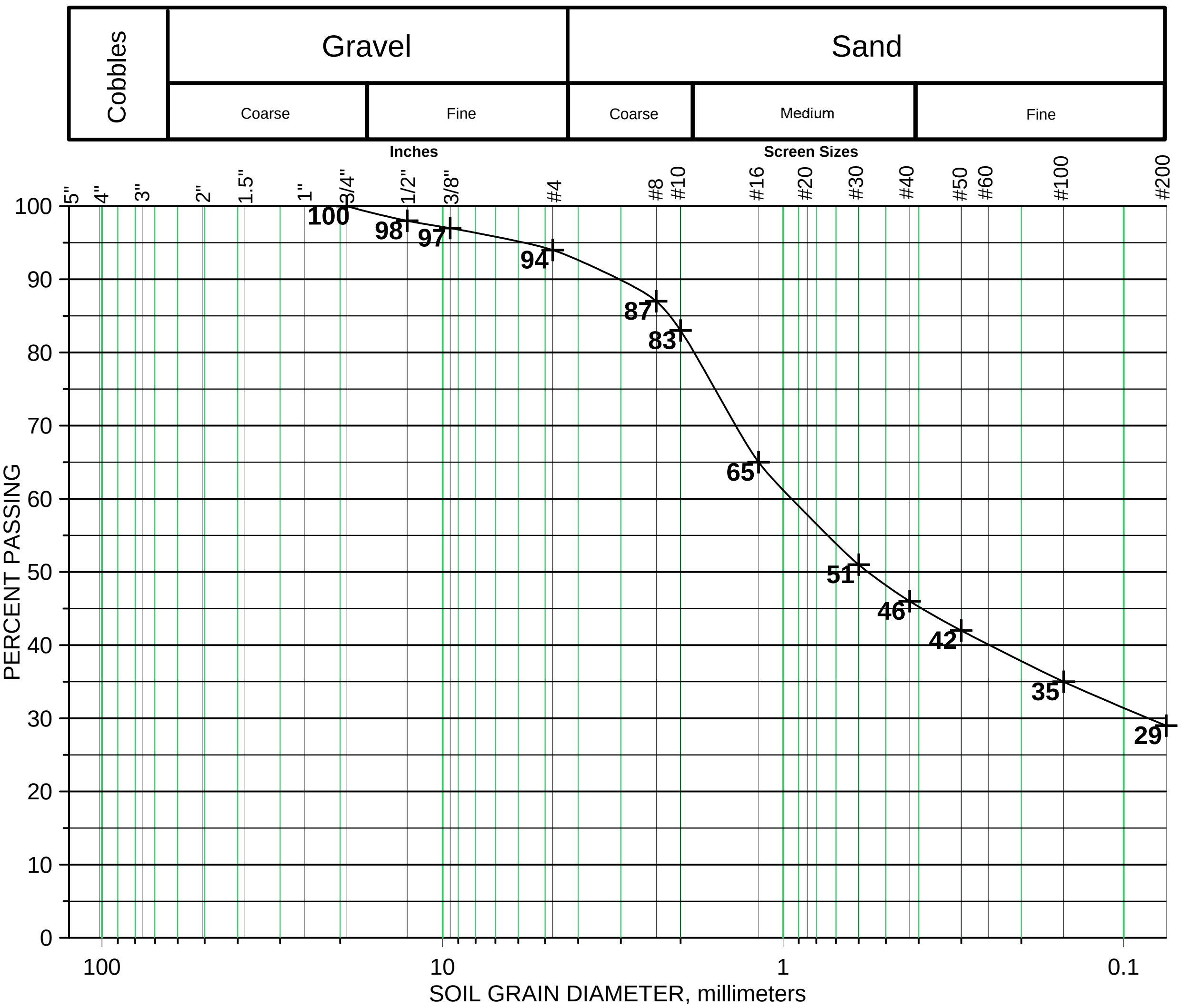
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145A
Material Source: PZF 14-1A, 160'-170'
Sample Classification: -



Reviewed by:________________

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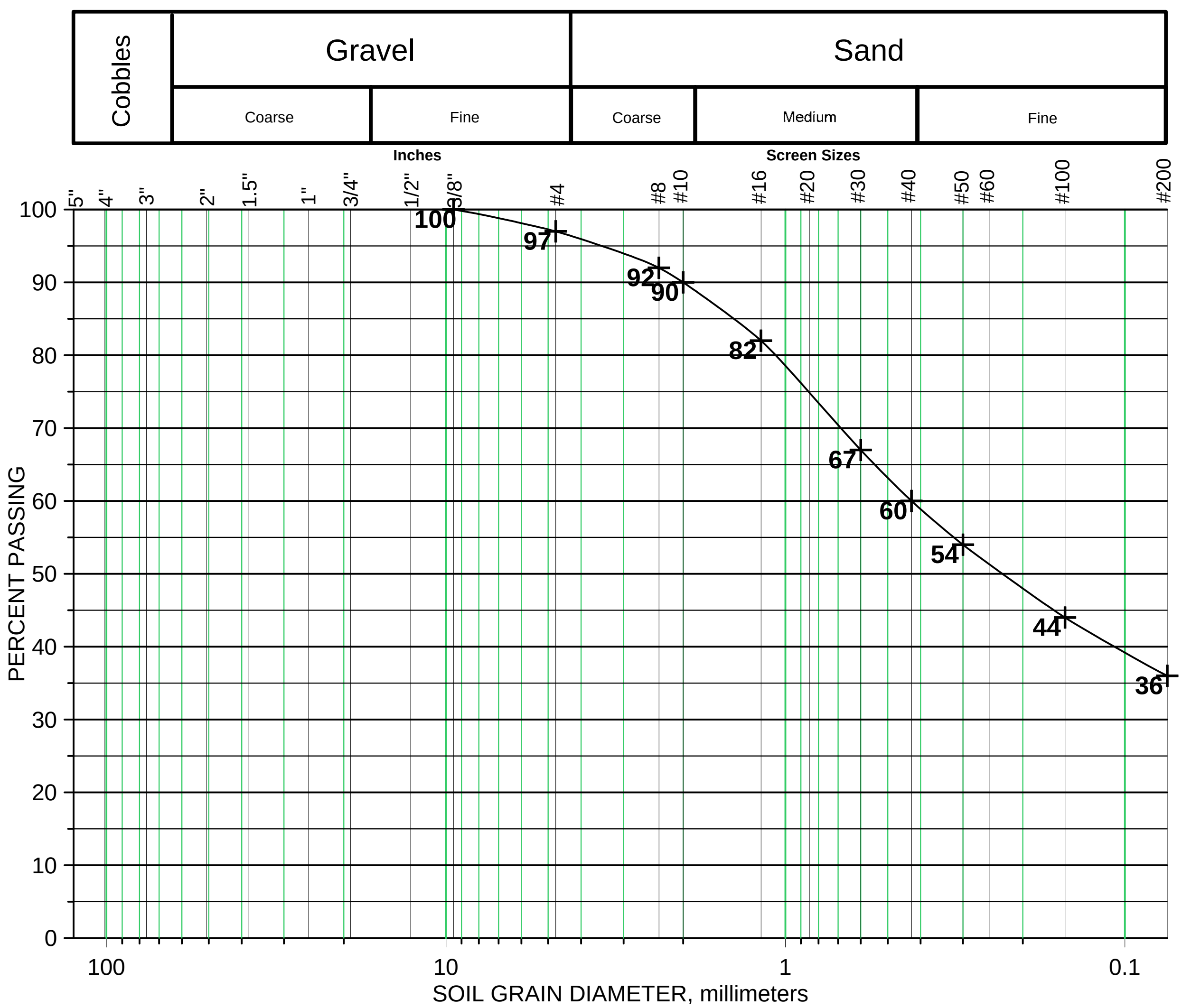
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145B
Material Source: PZF 14-1A, 170'-180'
Sample Classification: -



Reviewed by:____________________

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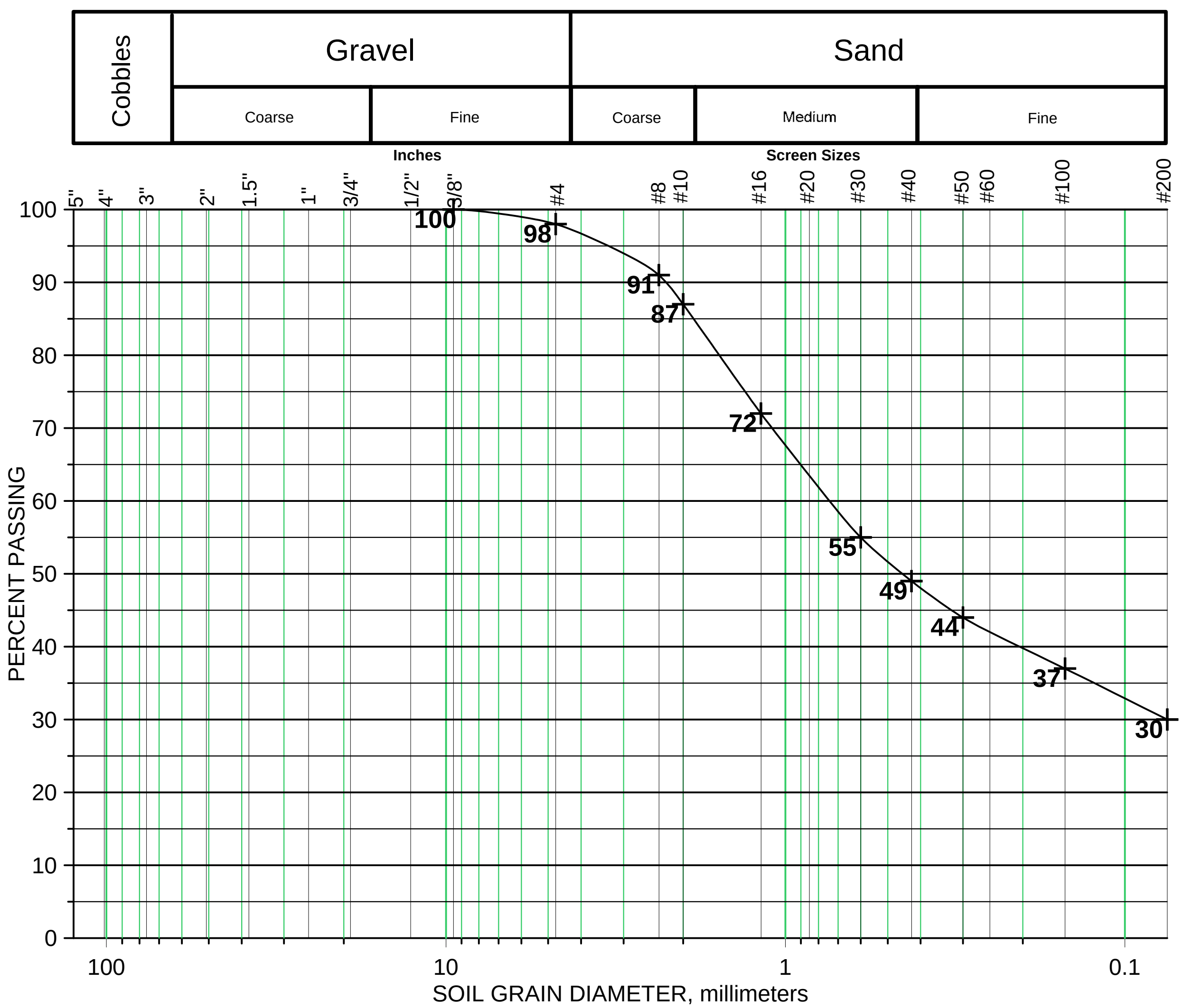
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145C
Material Source: PZF 14-1A, 180'-190'
Sample Classification: -



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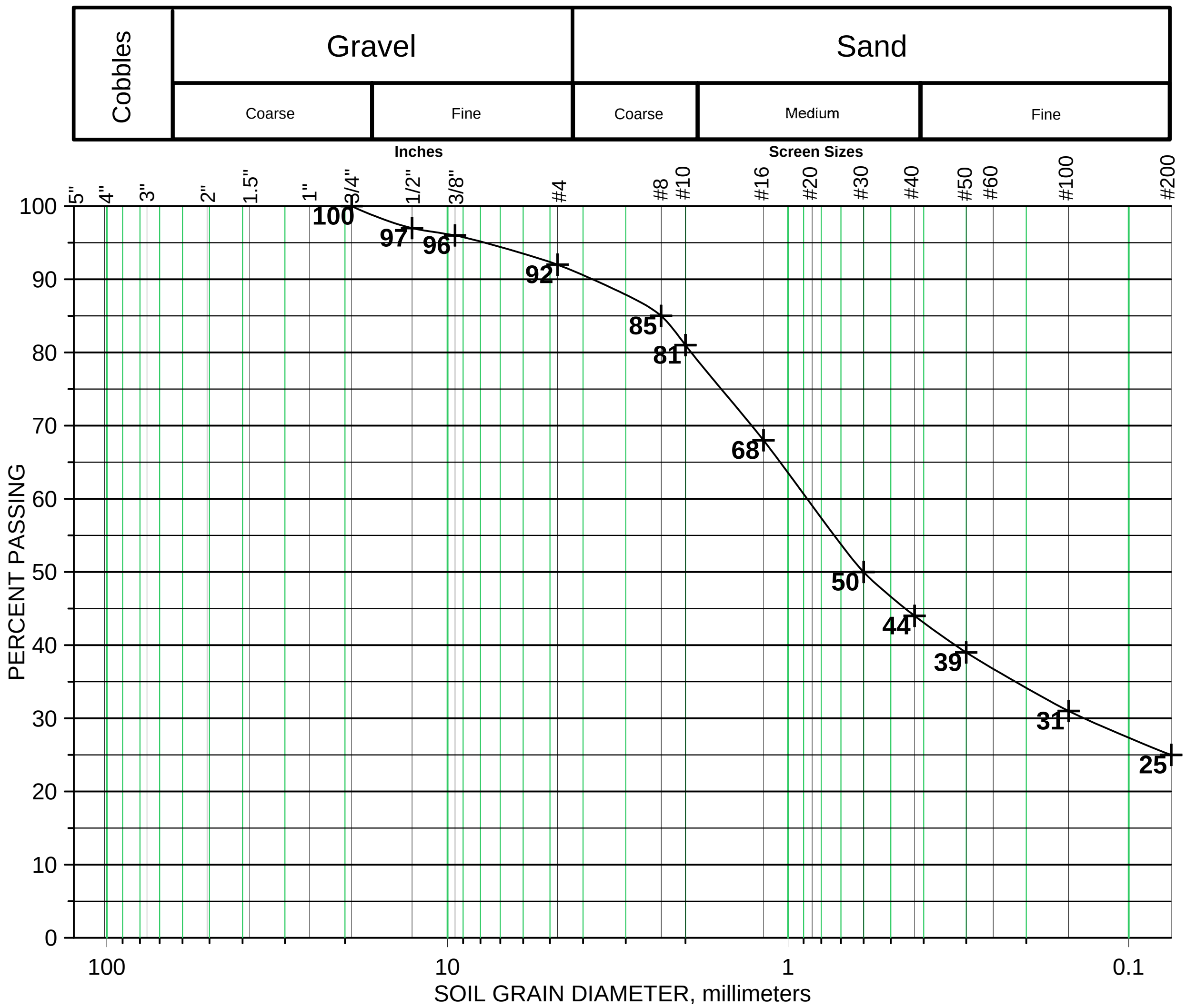
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145D
Material Source: PZF 14-1A, 190'-200'
Sample Classification: -



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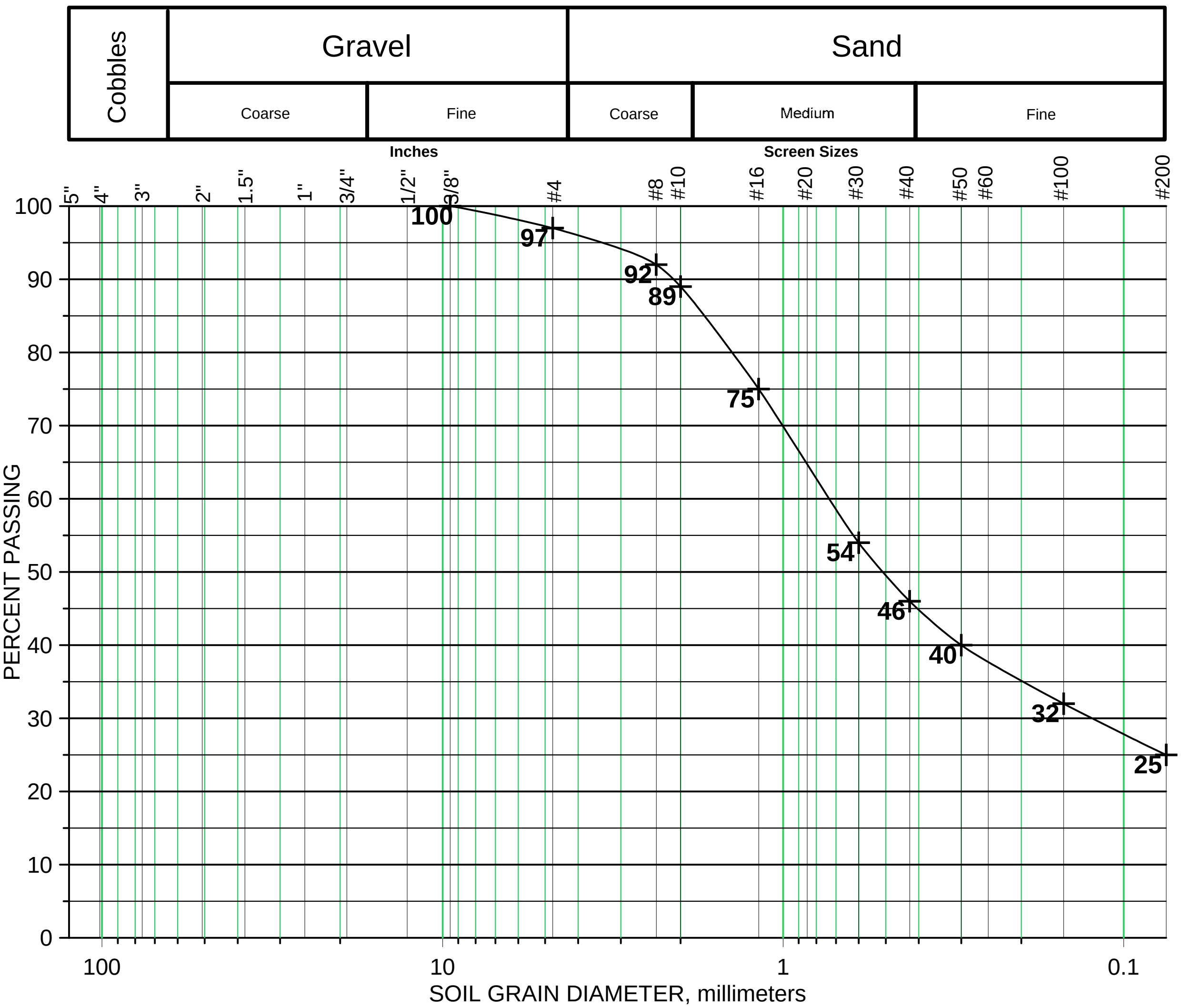
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145E
Material Source: PZF 14-1A, 200'-210'
Sample Classification: -



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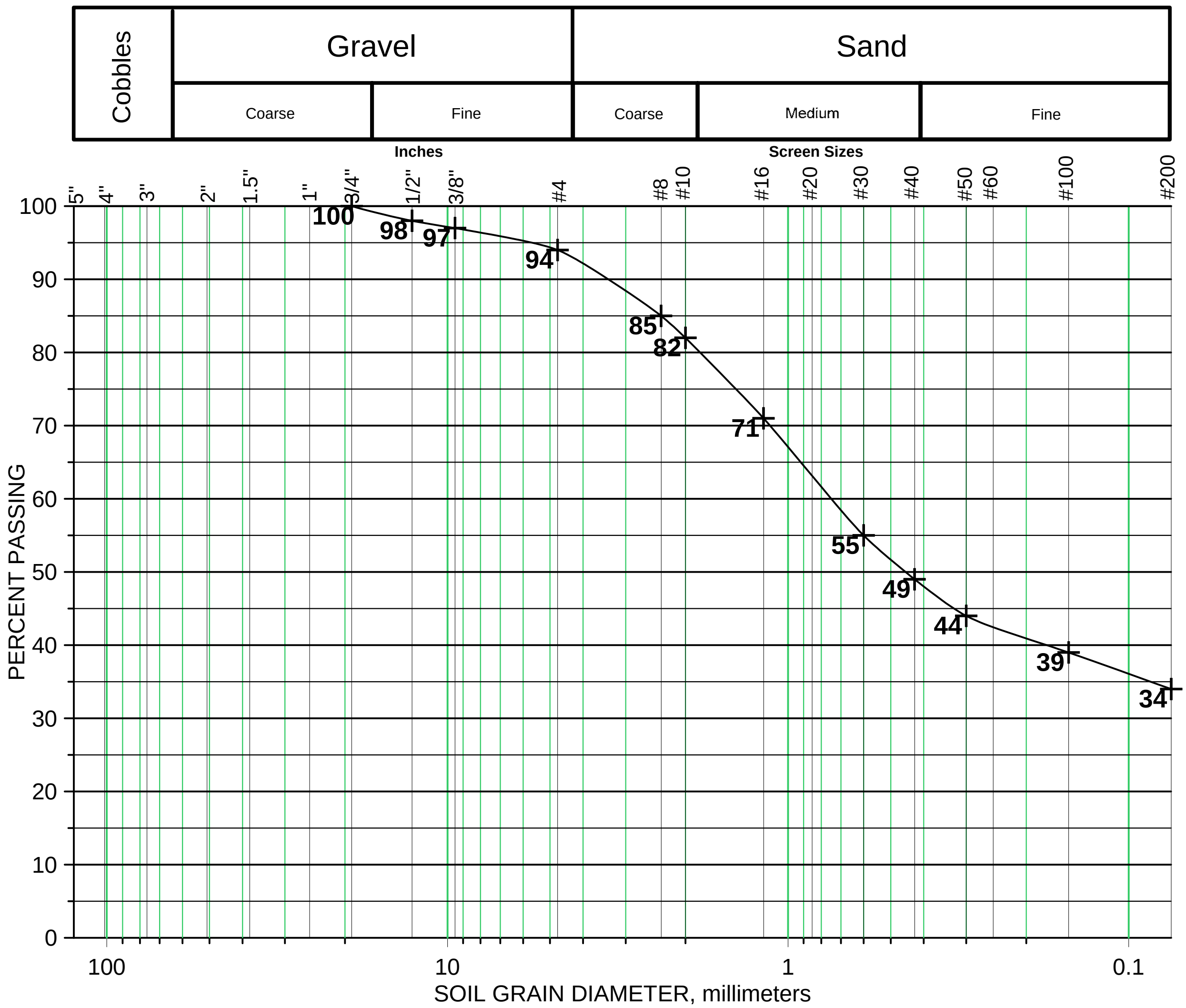
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145N
Material Source: PZF 14-1A, 310'-320'
Sample Classification: -



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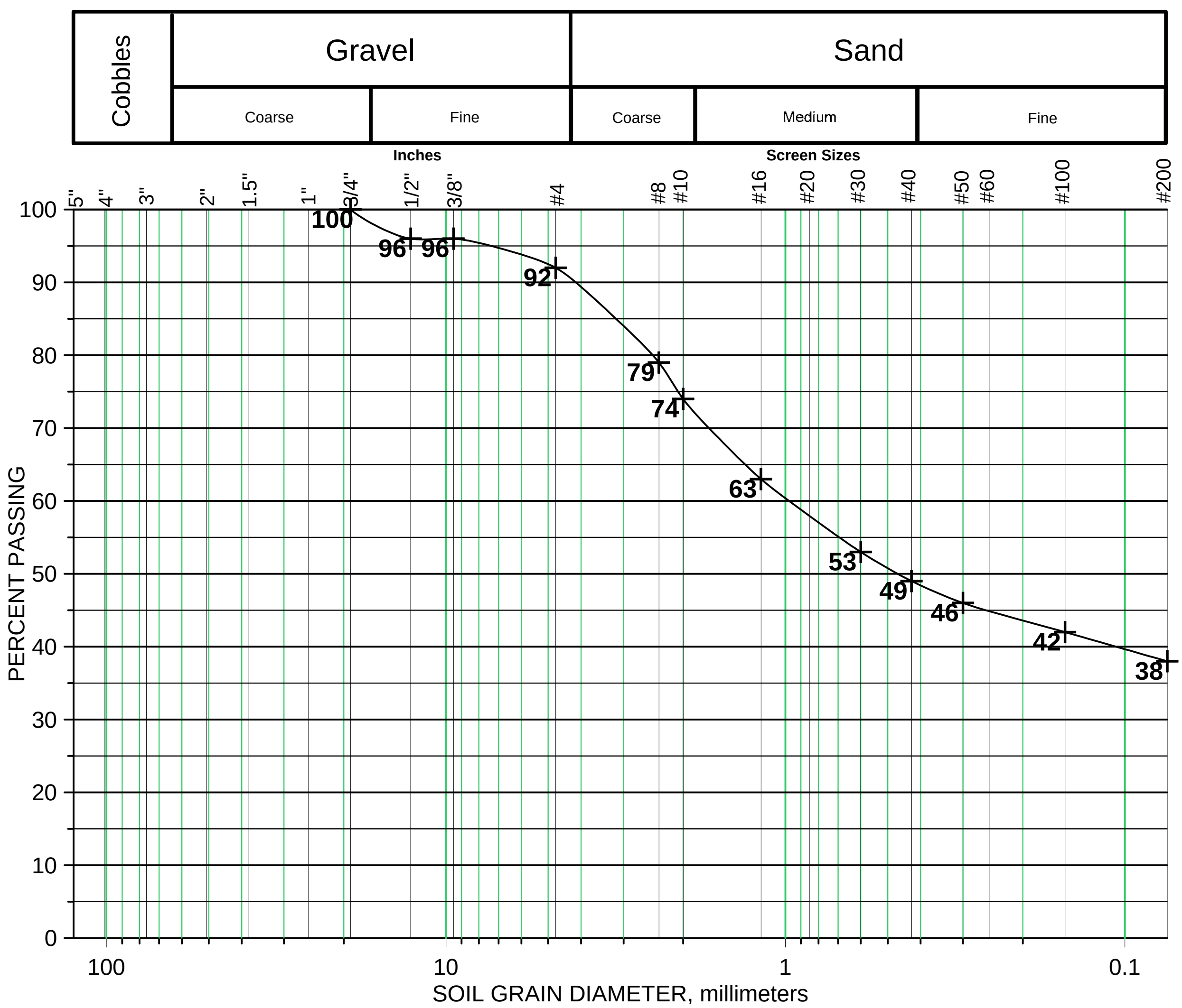
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI14001450
Material Source: PZF 14-1A, 320'-330'
Sample Classification: -



Reviewed by:____________________

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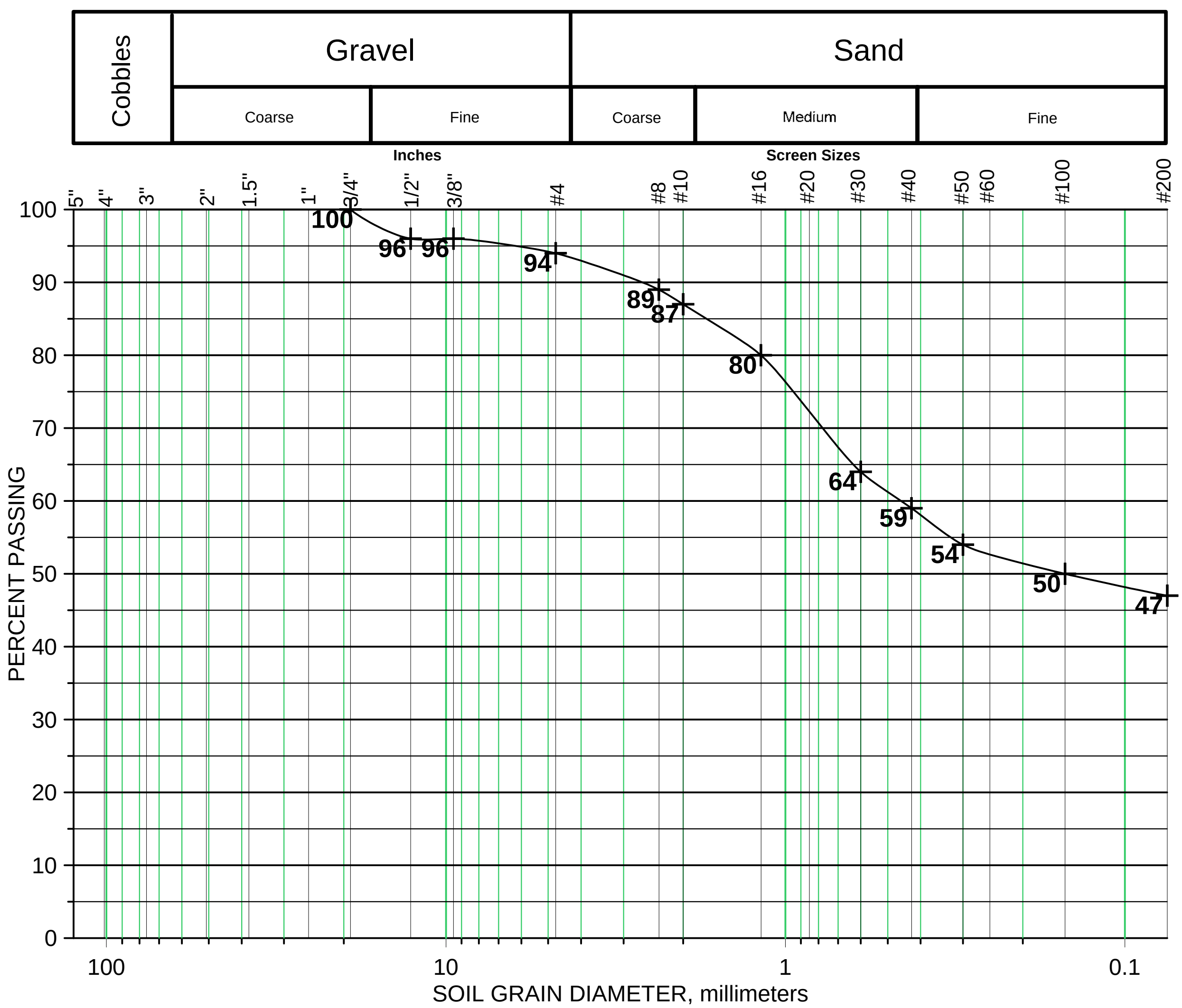
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145P
Material Source: PZF 14-1A, 330'-340'
Sample Classification: -



Reviewed by:

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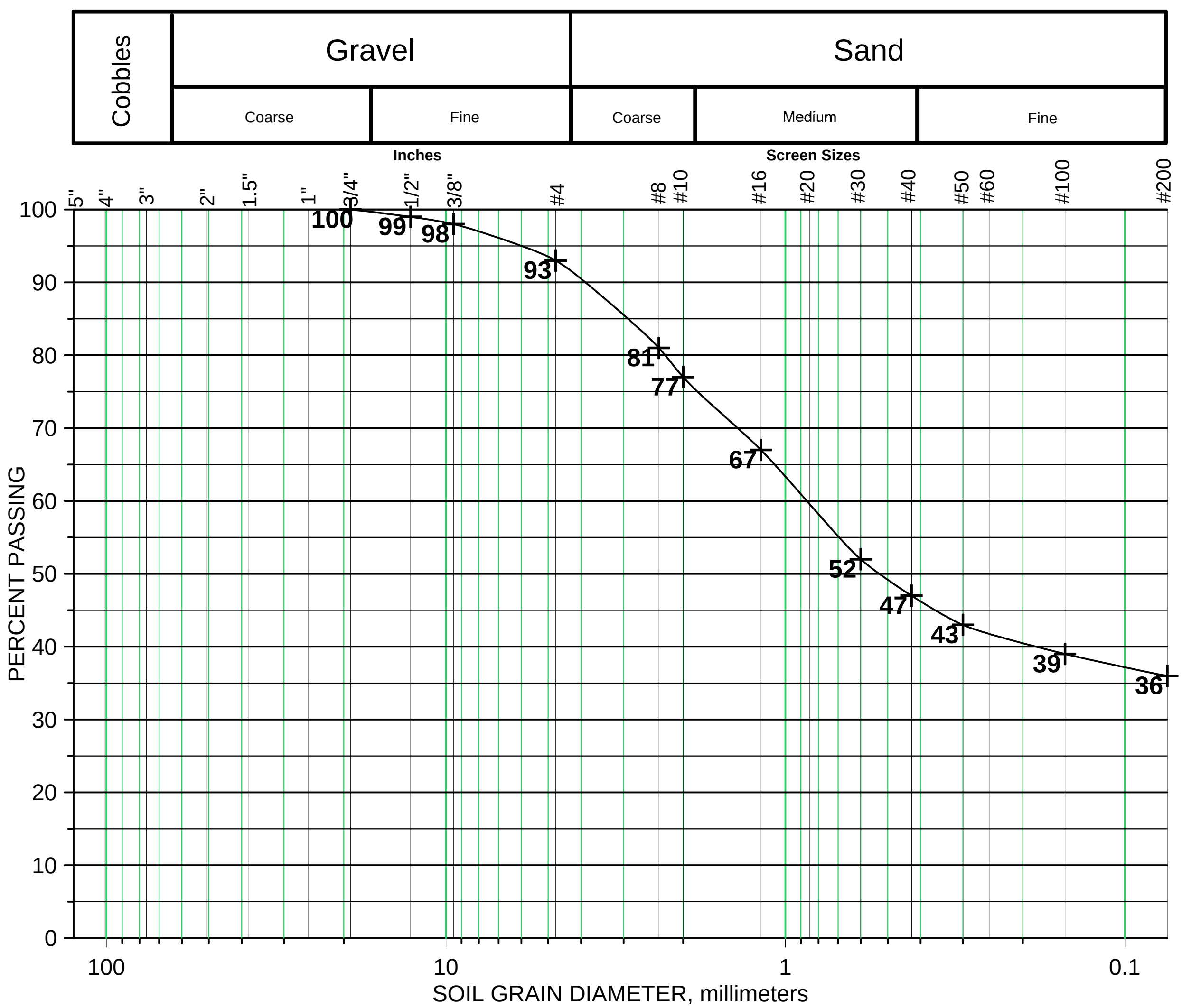
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145Q
Material Source: PZF 14-1A, 340'-350'
Sample Classification: -



Reviewed by:

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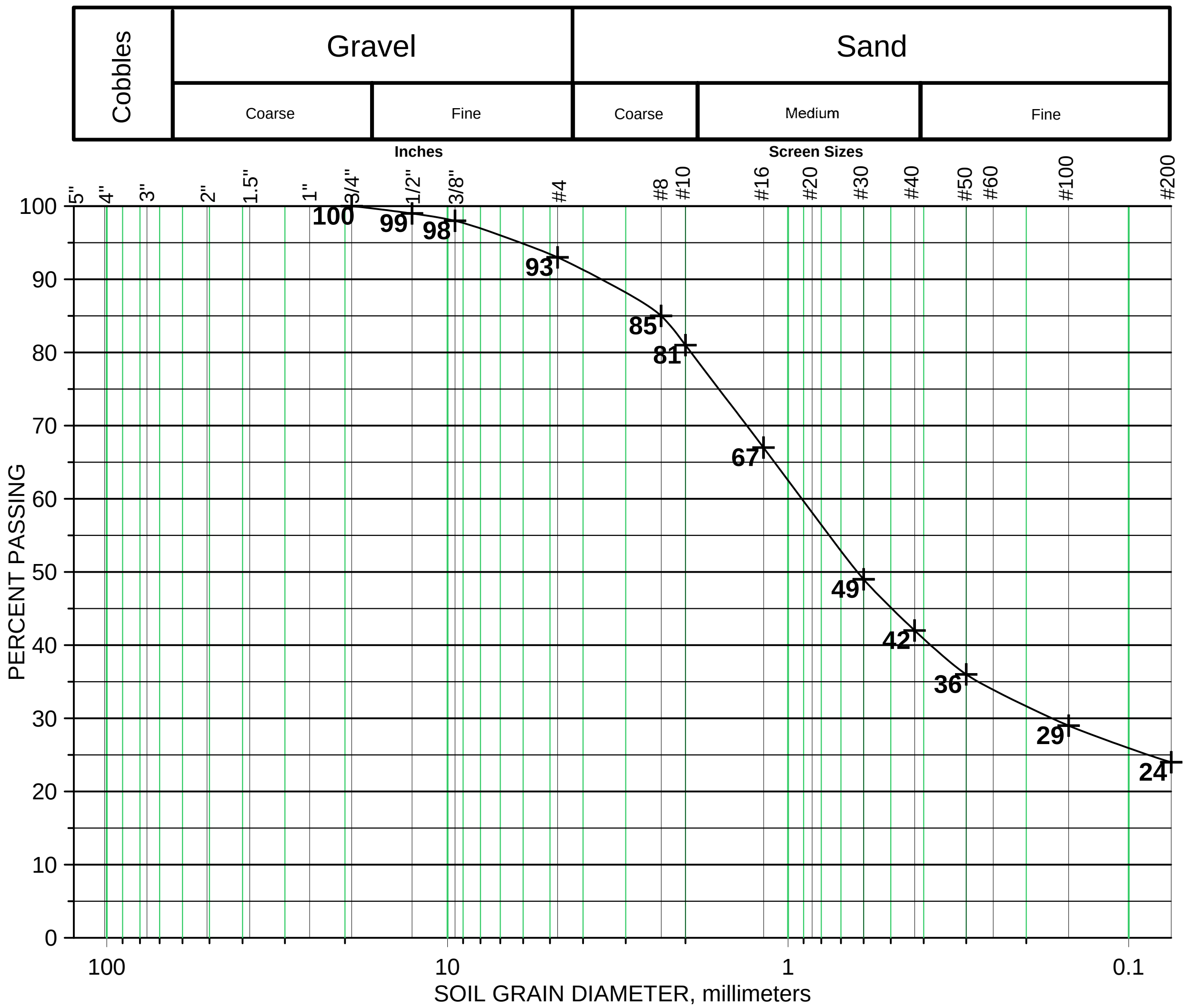
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145R
Material Source: PZF 14-1A, 350'-360'
Sample Classification: -



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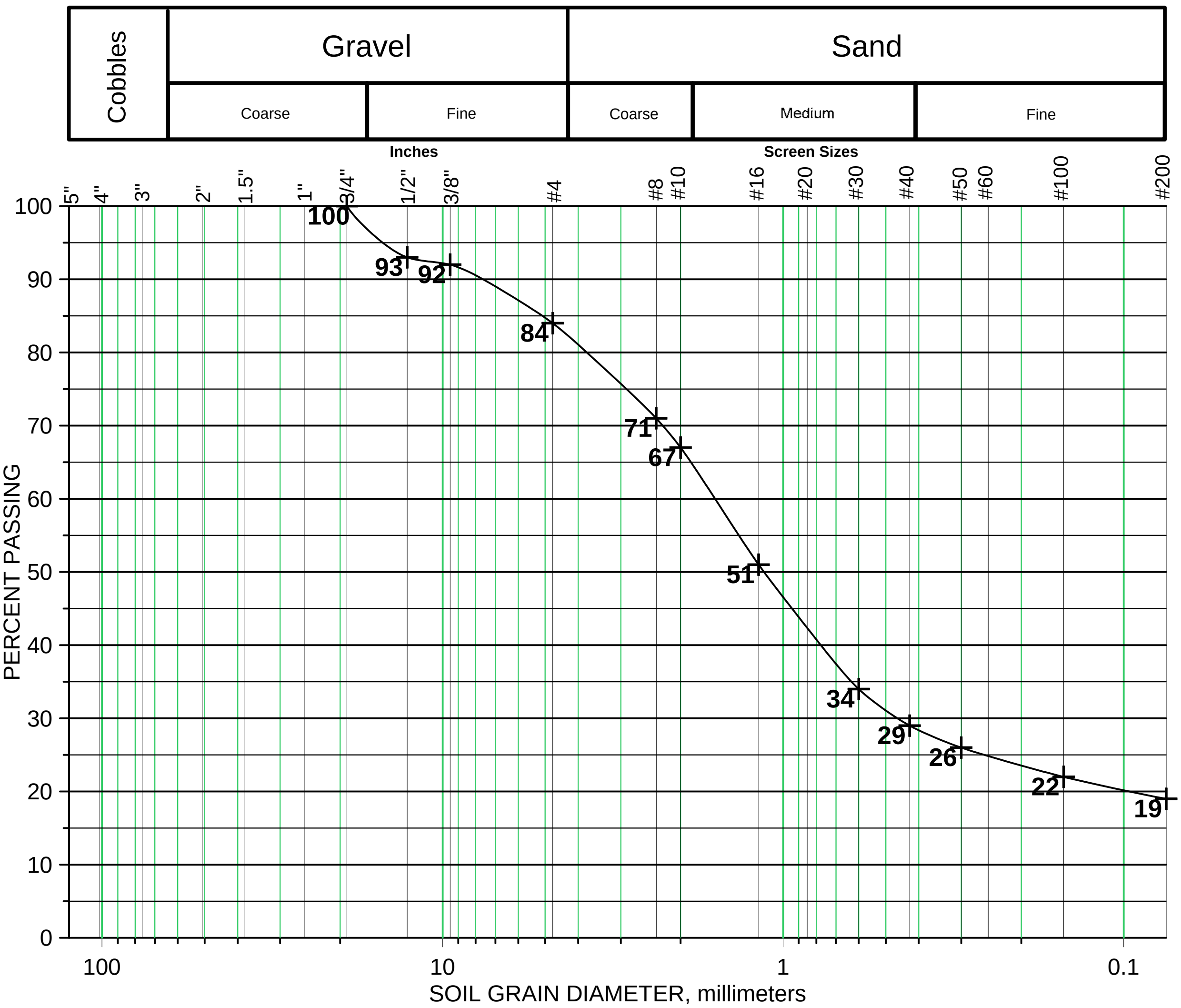
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145S
Material Source: PZF 14-1A, 360'-370'
Sample Classification: -



Reviewed by:

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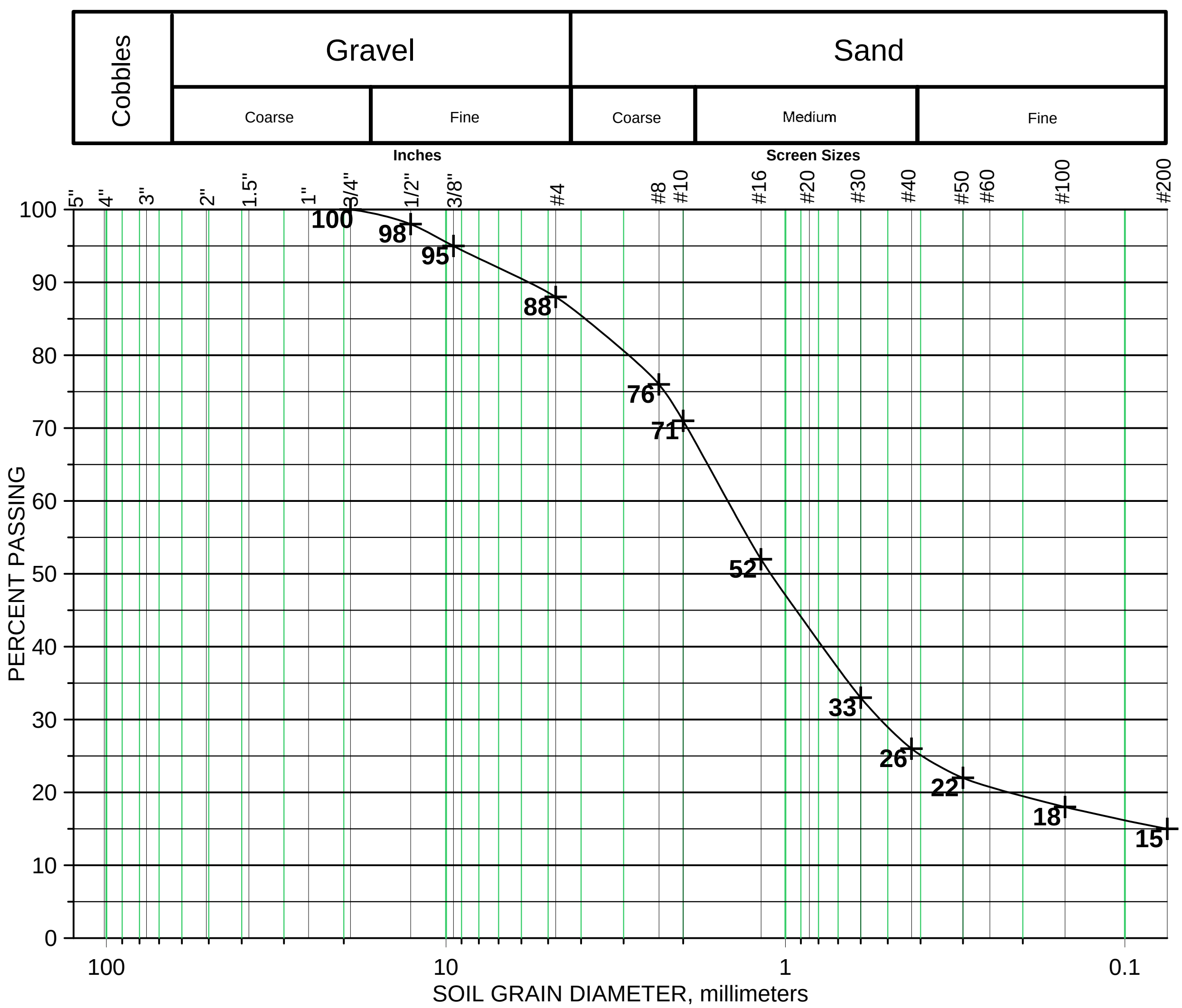
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145T
Material Source: PZF 14-1A, 370'-380'
Sample Classification: -



Reviewed by:

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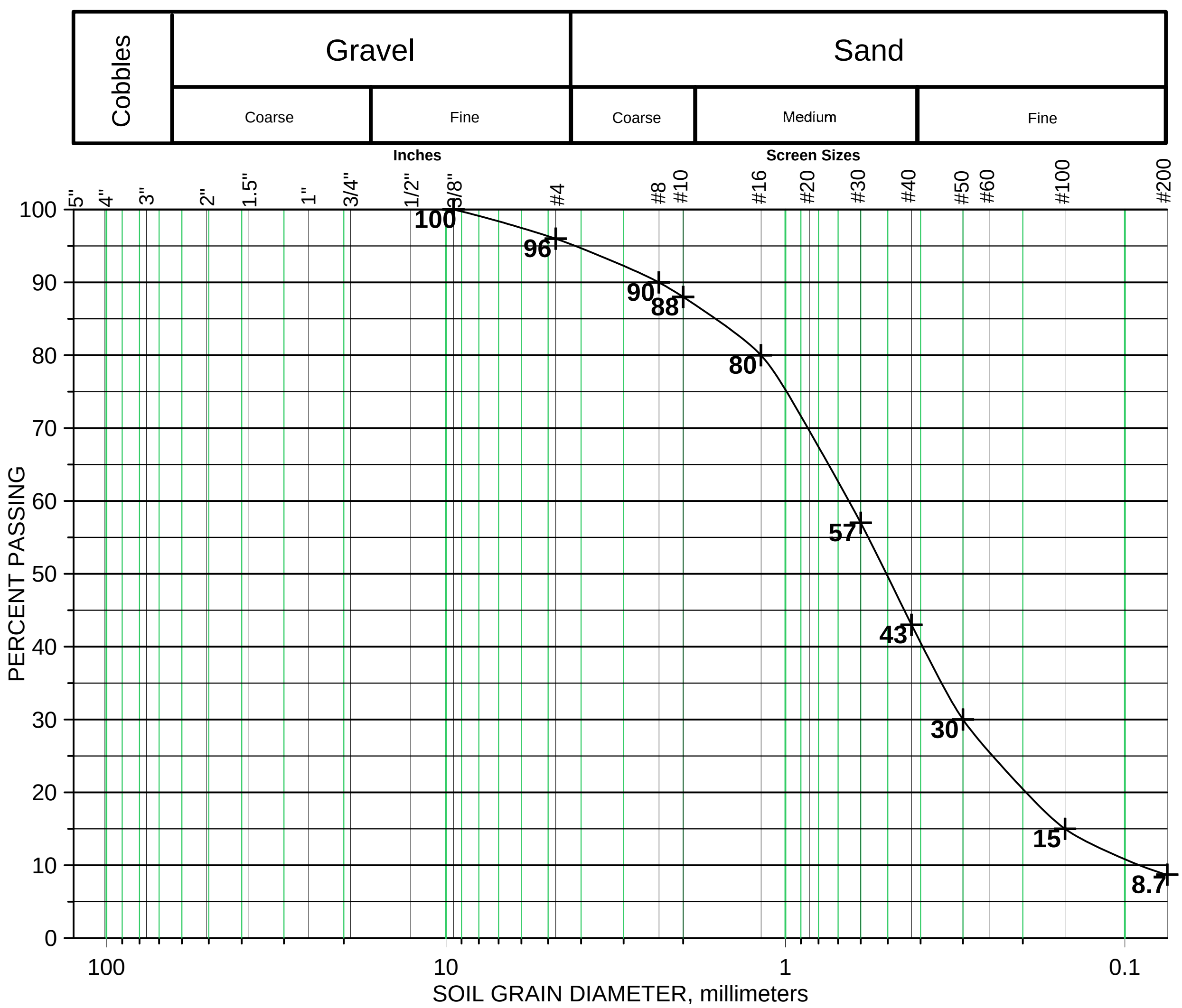
GRADATION ANALYSIS
ASTM C136, C117

Project: Berkeley Pit Slope Stability
Client: Montana Resources
Project Number: MONRES MI12065A
Lab Number: MI1400145U
Material Source: PZF 14-1A, 380'-390'
Sample Classification: -



Reviewed by:

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

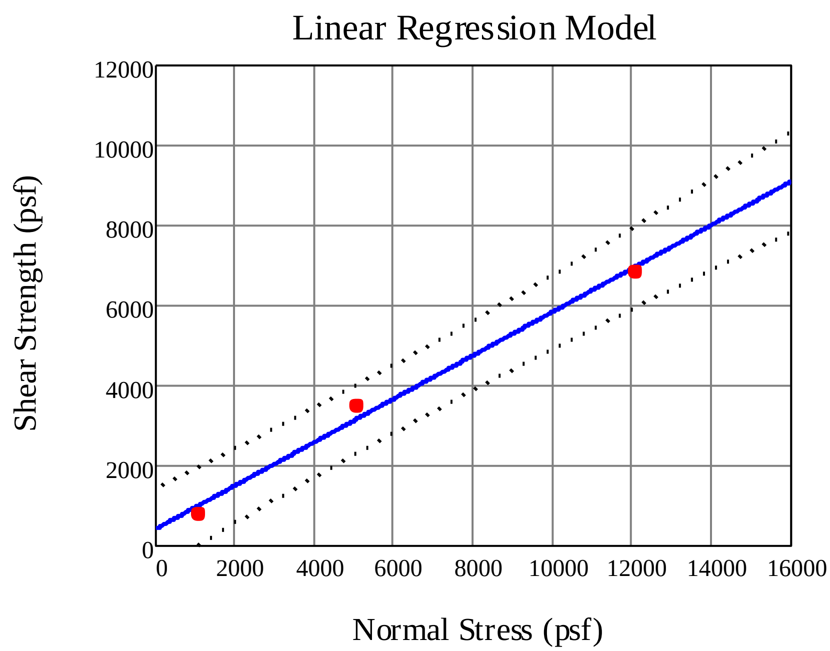
Sample ID: PZF14-1A @ 30-40 ft, remolded
Fill: Brown Clayey Sand (SC)
Tot. Unit Wt.=105.3 pcf; w=15.5%
Residual Strength; June 2014

$$D := \begin{pmatrix} 1040 & 785 \\ 5050 & 3487 \\ 12080 & 6859 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



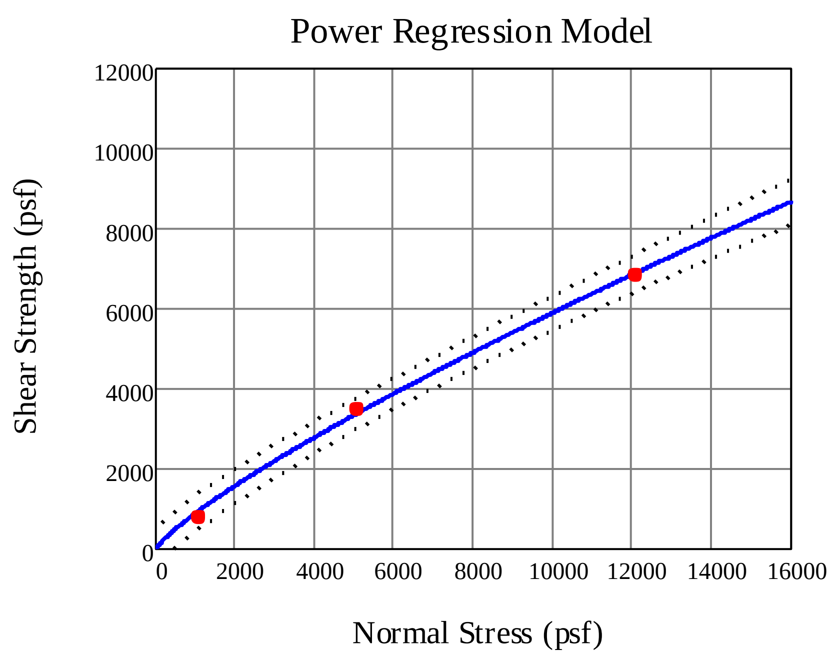
Linear Regression Coefs.: Y = C + MX

$C = 426.5$ $M = 0.54219$

$\phi = 28.5$

$S_e = 399.84$

$MD = 214.98$



Power Regression Coefs.: $Y = AX^B$

$A = 3.15416$ $B = 0.81811$

$s_e = 182.85$

$md = 95.49$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

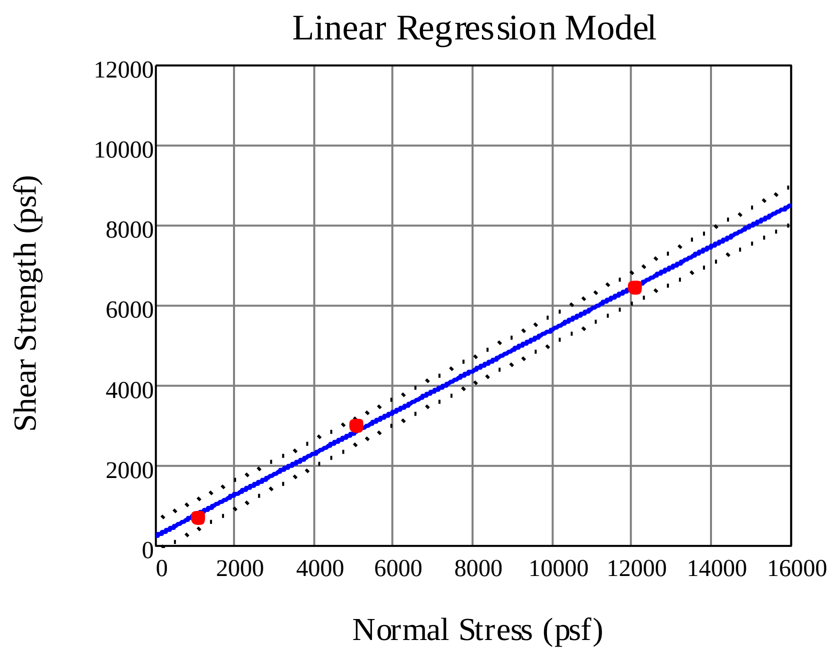
Sample ID: PZF14-1A @ 70-80 ft, remolded
Fill: Brown Clayey Sand (SC)
Tot. Unit Wt.=105.7 pcf; w=15.7%
Residual Strength; June 2014

$$D := \begin{pmatrix} 1040 & 709 \\ 5050 & 2982 \\ 12080 & 6446 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



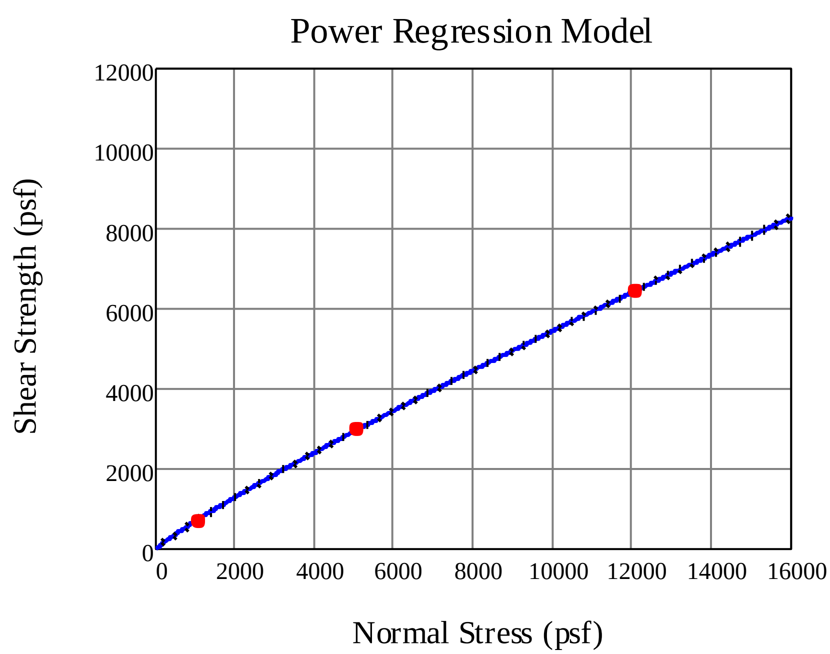
Linear Regression Coefs.: Y = C + MX

$C = 250.1$ $M = 0.51661$

$\phi = 27.3$

$S_e = 152.57$

$MD = 82.03$



Power Regression Coefs.: $Y = AX^B$

$A = 1.50733$ $B = 0.88958$

$s_e = 23.37$

$md = 11.98$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

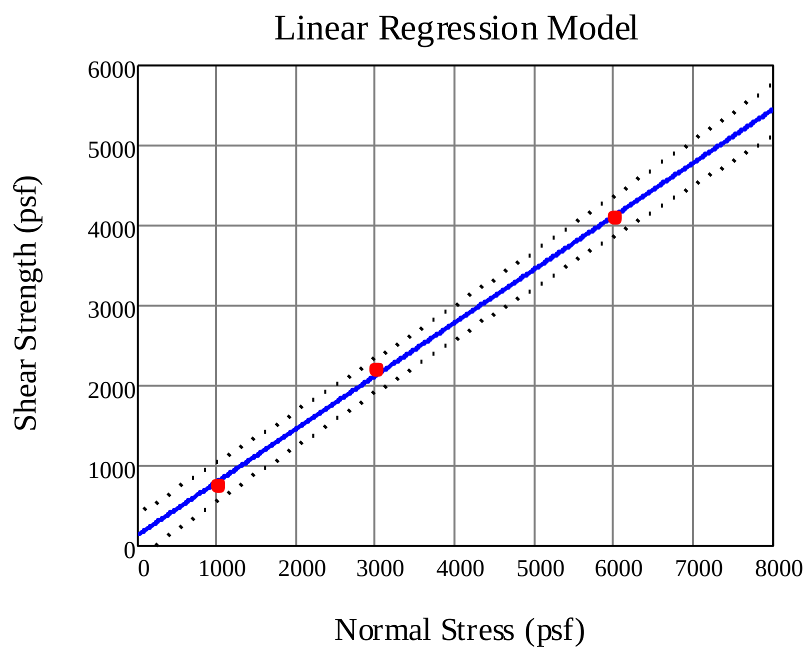
Sample ID: PZF12-7 @ 21 ft
Fill: Silty Sand (SM), Nonplastic
Residual Strength, Jan. 2013

$$D := \begin{pmatrix} 1000 & 754 \\ 3000 & 2211 \\ 6000 & 4091 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 8000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



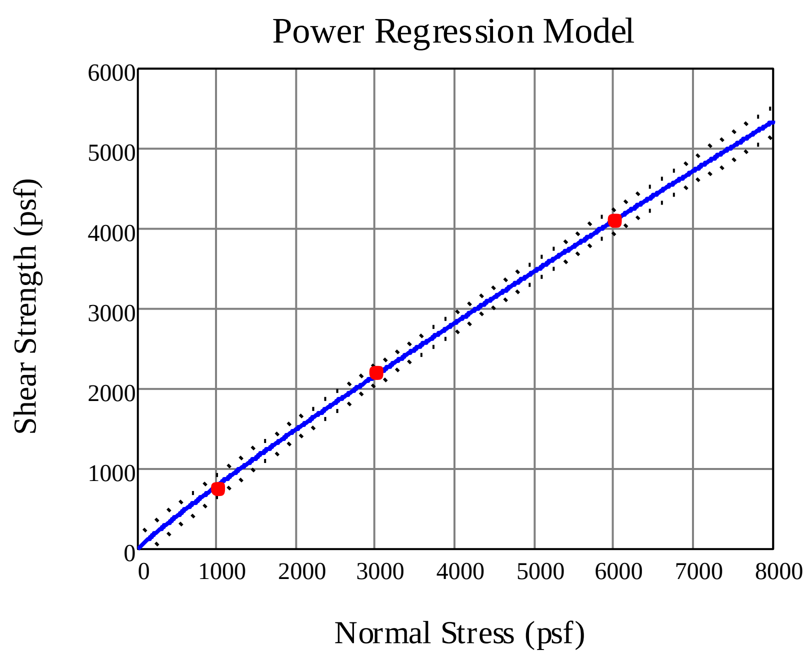
Linear Regression Coefs.: Y = C + MX

$C = 138.1$ $M = 0.66418$

$\phi = 33.6$

$S_e = 99.12$

$MD = 53.60$



Power Regression Coefs.: $Y = AX^B$

$A = 1.41039$ $B = 0.91679$

$s_e = 56.10$

$md = 29.87$

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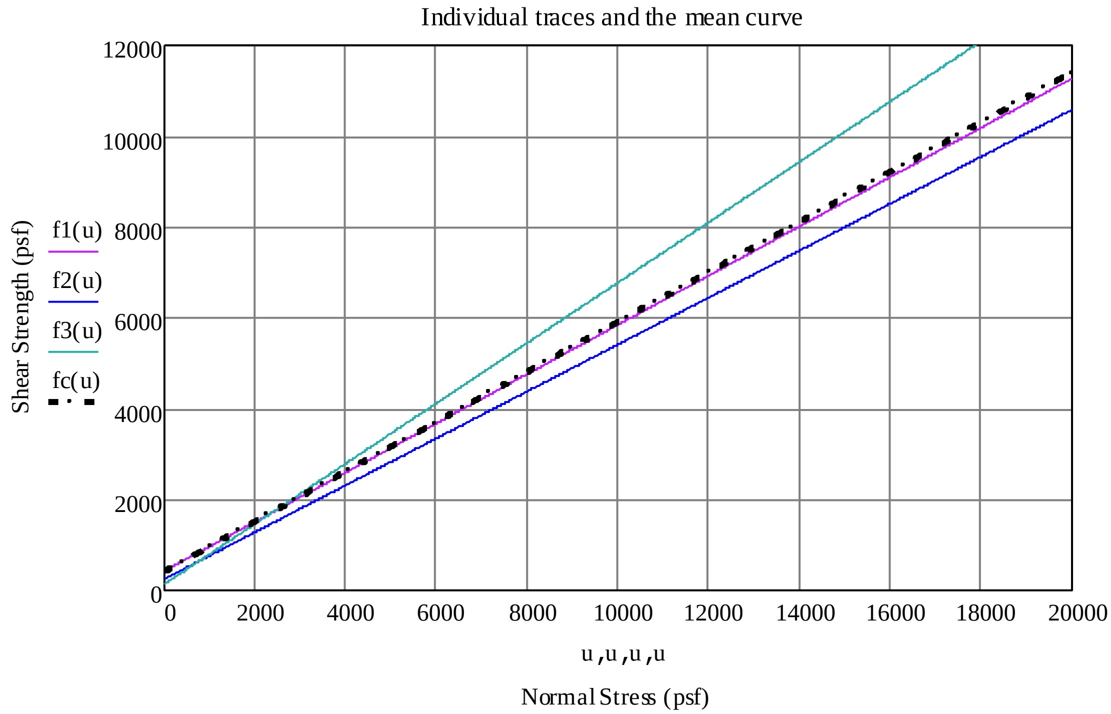
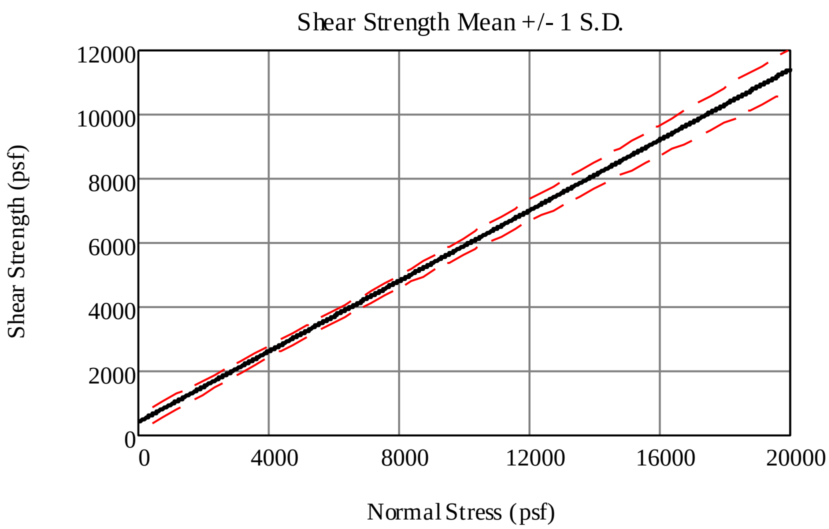
Shear-Strength Linear Regression Combiner for the 3 Individual Tests; Pittsmont Dump Fill



Mean Fit:

Cohes = 419 psf

ϕ = 28.8 deg



Mean +1sd

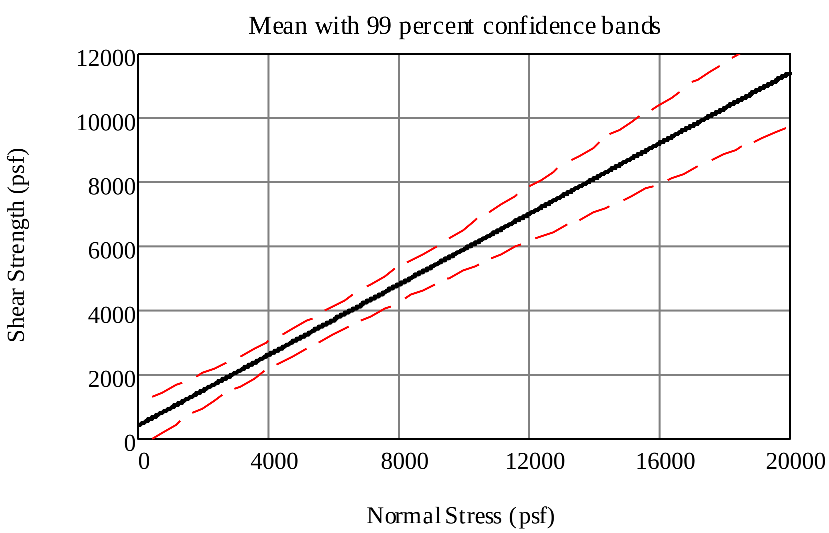
CohesP = 503

ϕp = 29.8

Mean -1sd

CohesM = 335

ϕm = 27.7



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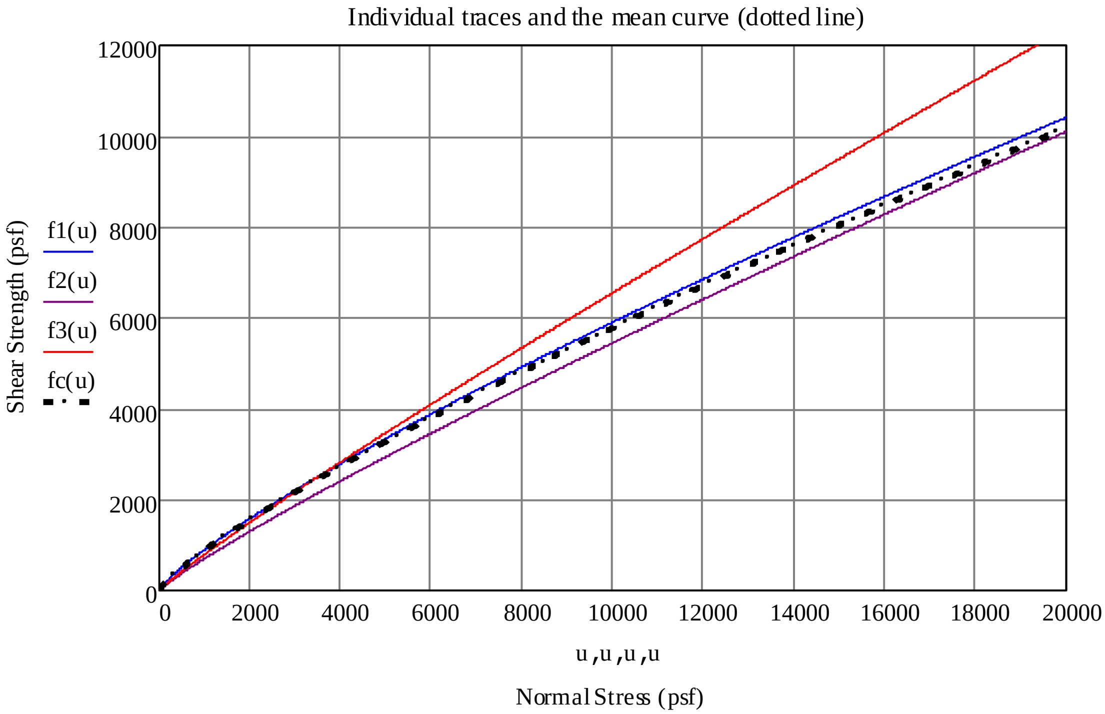
Shear-Strength Power Regression Combiner for the 3 Individual Tests; Pittsmont Dump Fill

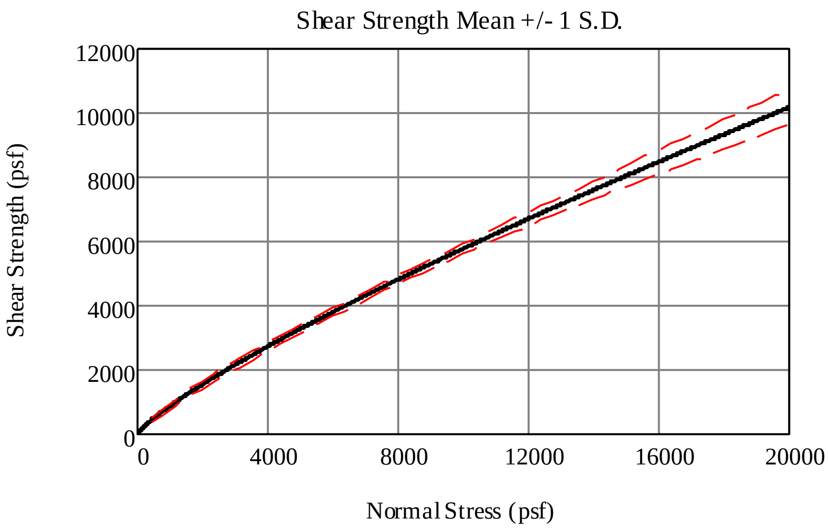


Mean Fit:

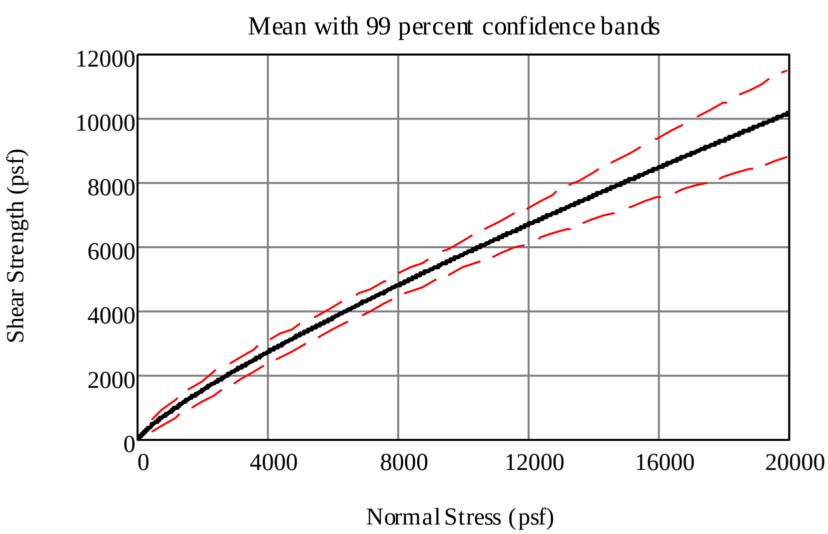
$Y = A\ X^{B}$

A = 3.1544

B = 0.8158



Mean +1sd	Mean -1sd
Ap = 3.0301	Am = 3.2903
Bp = 0.8243	Bm = 0.8069



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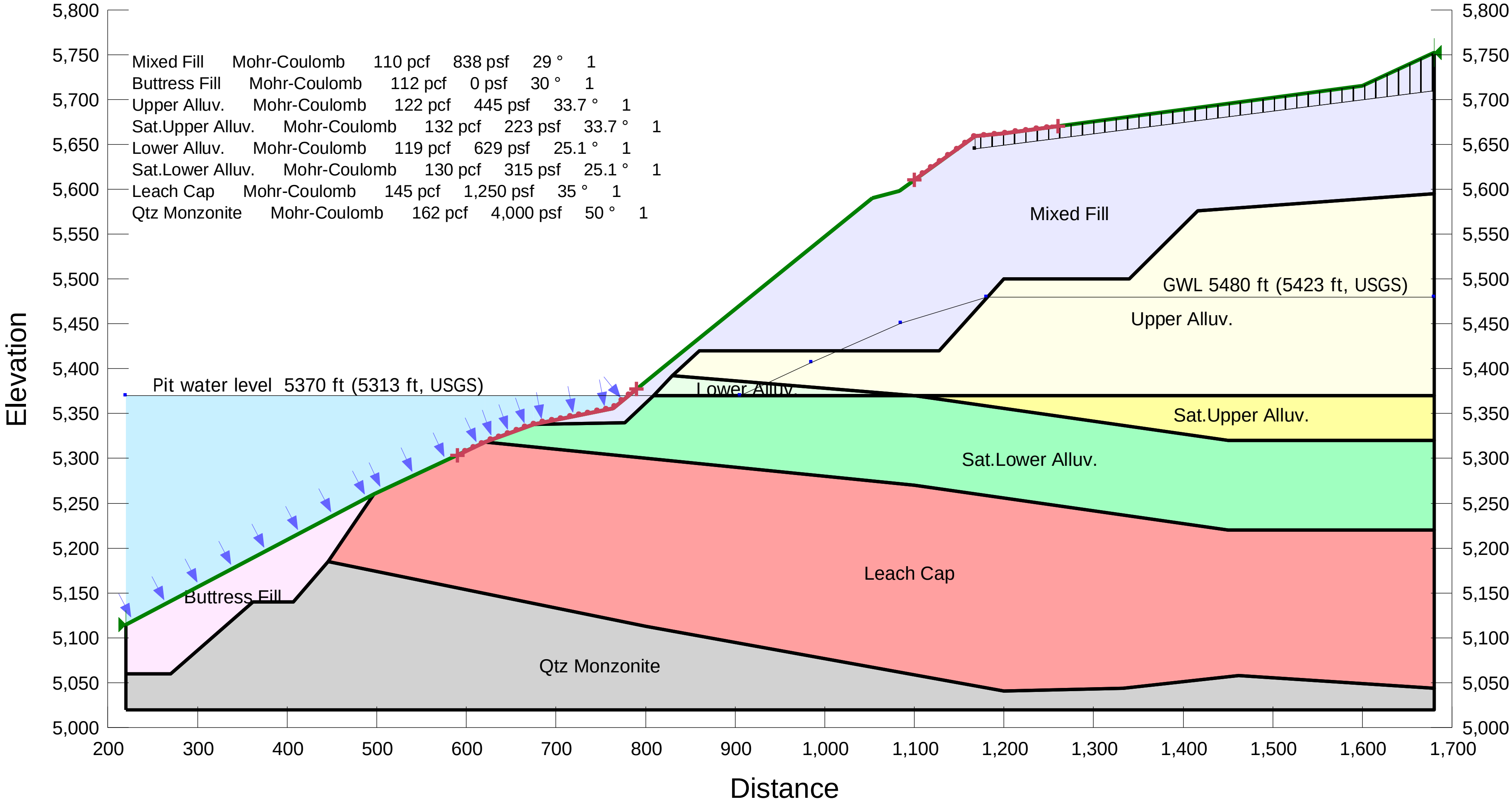
ATTACHMENT 2

Summary of Slope Stability Analysis Results

Pittsmont Cross-Sections 383E-N67W and 385E-N67W

Pittsmont Sector: Cross-Section 383E N67W, Pit Water Level 5370 ft, Groundwater Level 5480 ft



Notes:
1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.

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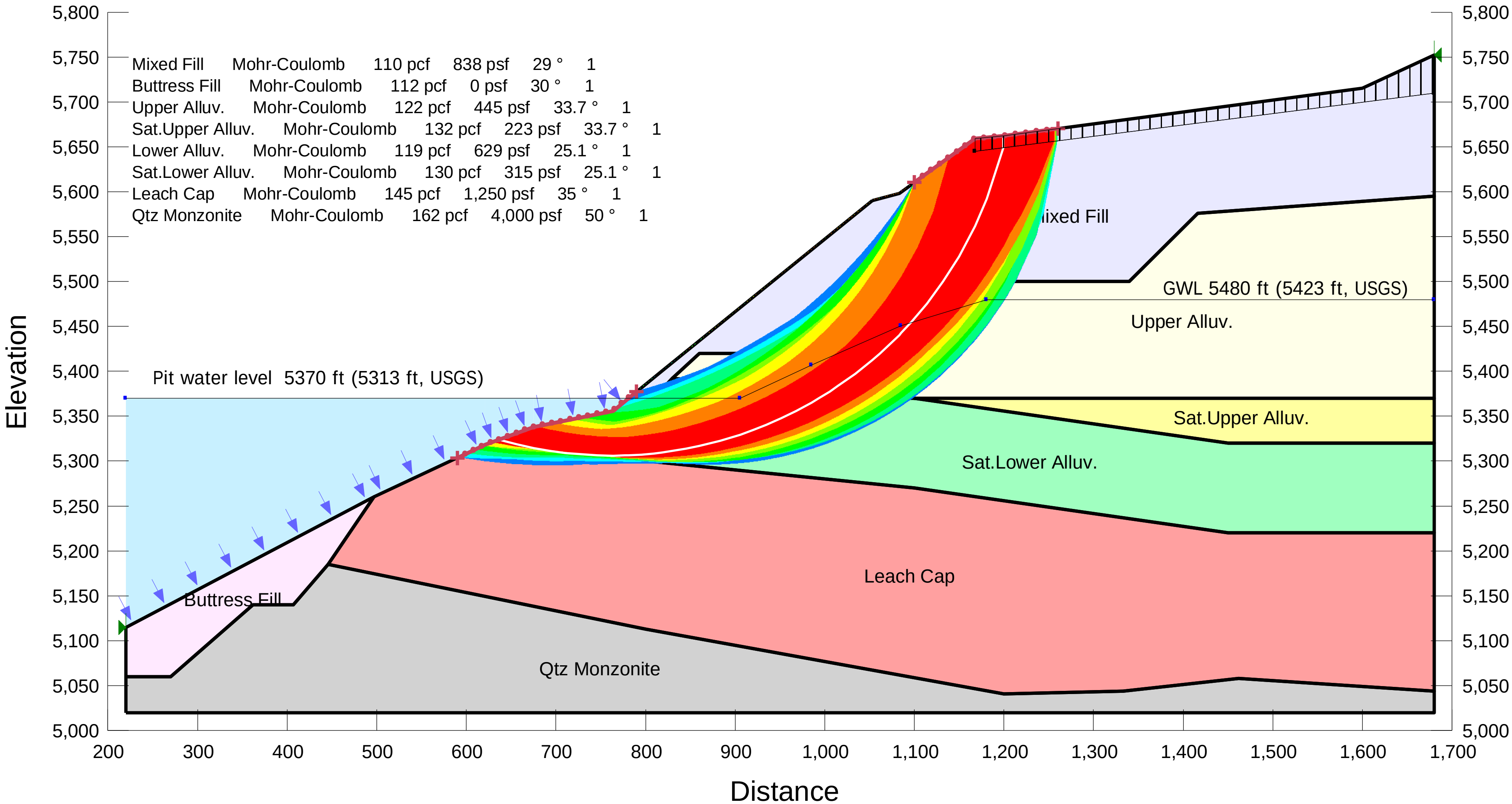
Scale as Shown; Anaconda Elev. Datum

June 2014 MI14010B Figure 1

Pittsmont Sector: Cross-Section 383E N67W, Stability Analysis; Pit Water Level 5370 ft, Groundwater Level 5480 ft

Minimum Computed FOS for Mean Inputs 1.006



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.02.

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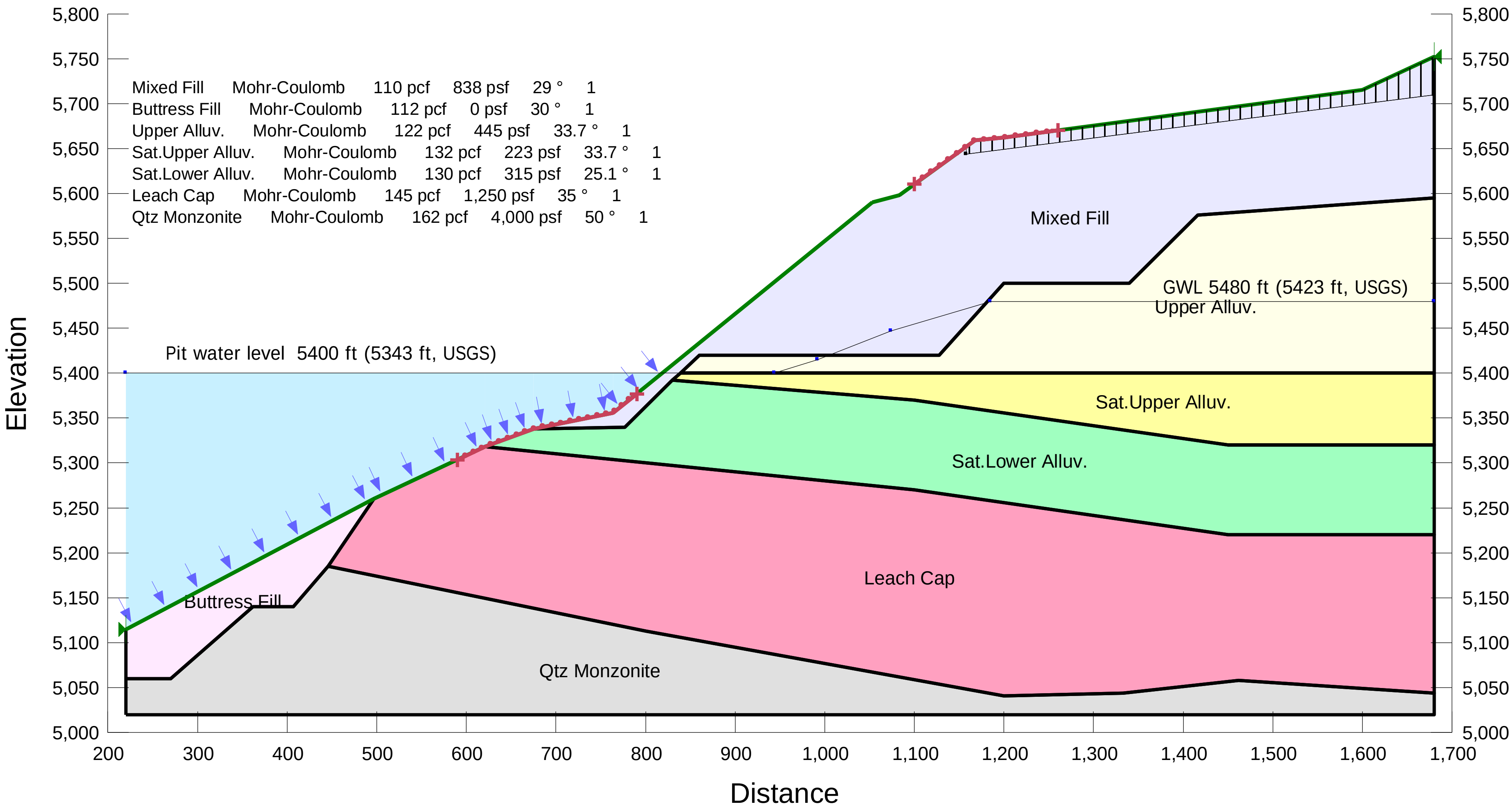
Scale as Shown; Anaconda Elev. Datum June 2014 MI14010B Figure 1A

Pittsmont Sector: Cross-Section 383E N67W, Pit Water Level 5400 ft, Groundwater Level 5480 ft



Notes:
1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.

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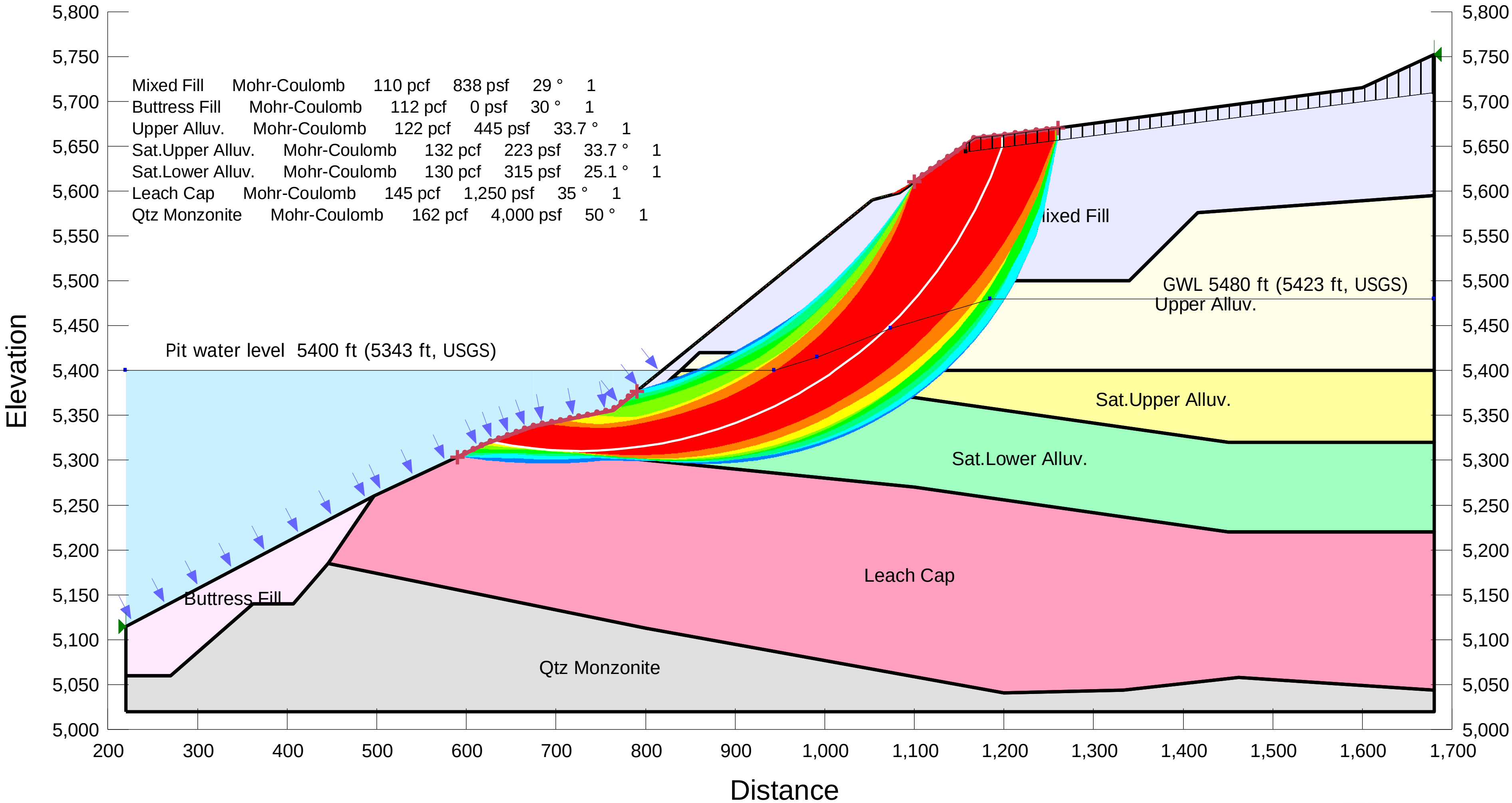
Scale as Shown; Anaconda Elev. Datum   June 2014   MI14010B   Figure 2

Pittsmont Sector: Cross-Section 383E N67W, Stability Analysis; Pit Water Level 5400 ft, Groundwater Level 5480 ft

Minimum Computed FOS for Mean Inputs 1.002



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.02.

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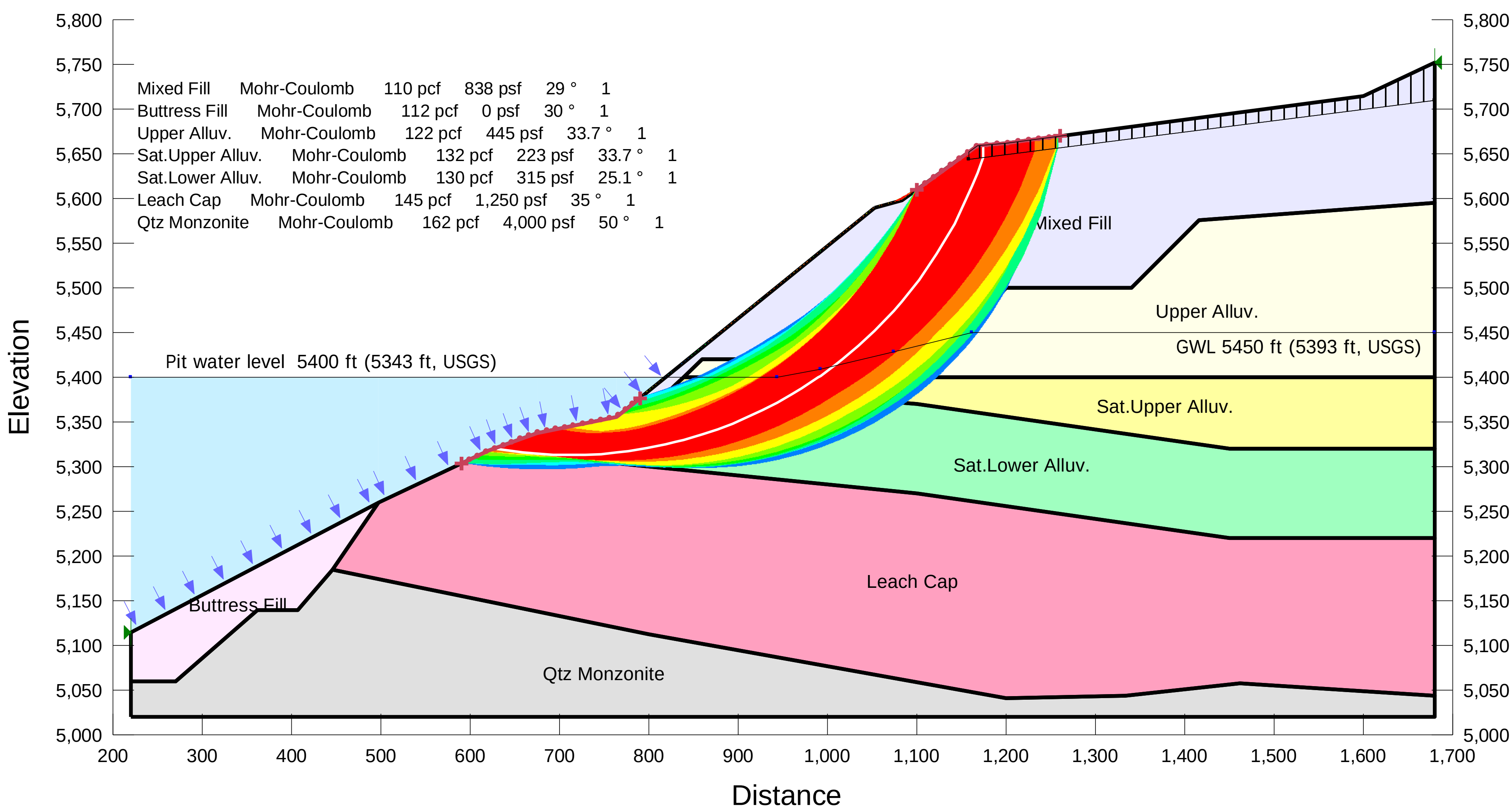
Scale as Shown; Anaconda Elev. Datum June 2014 MI14010B Figure 2A

Pittsmont Sector: Cross-Section 383E N67W, Stability Analysis; Pit Water Level 5400 ft, Groundwater Level 5450 ft

Minimum Computed FOS for Mean Inputs 1.012



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.02.

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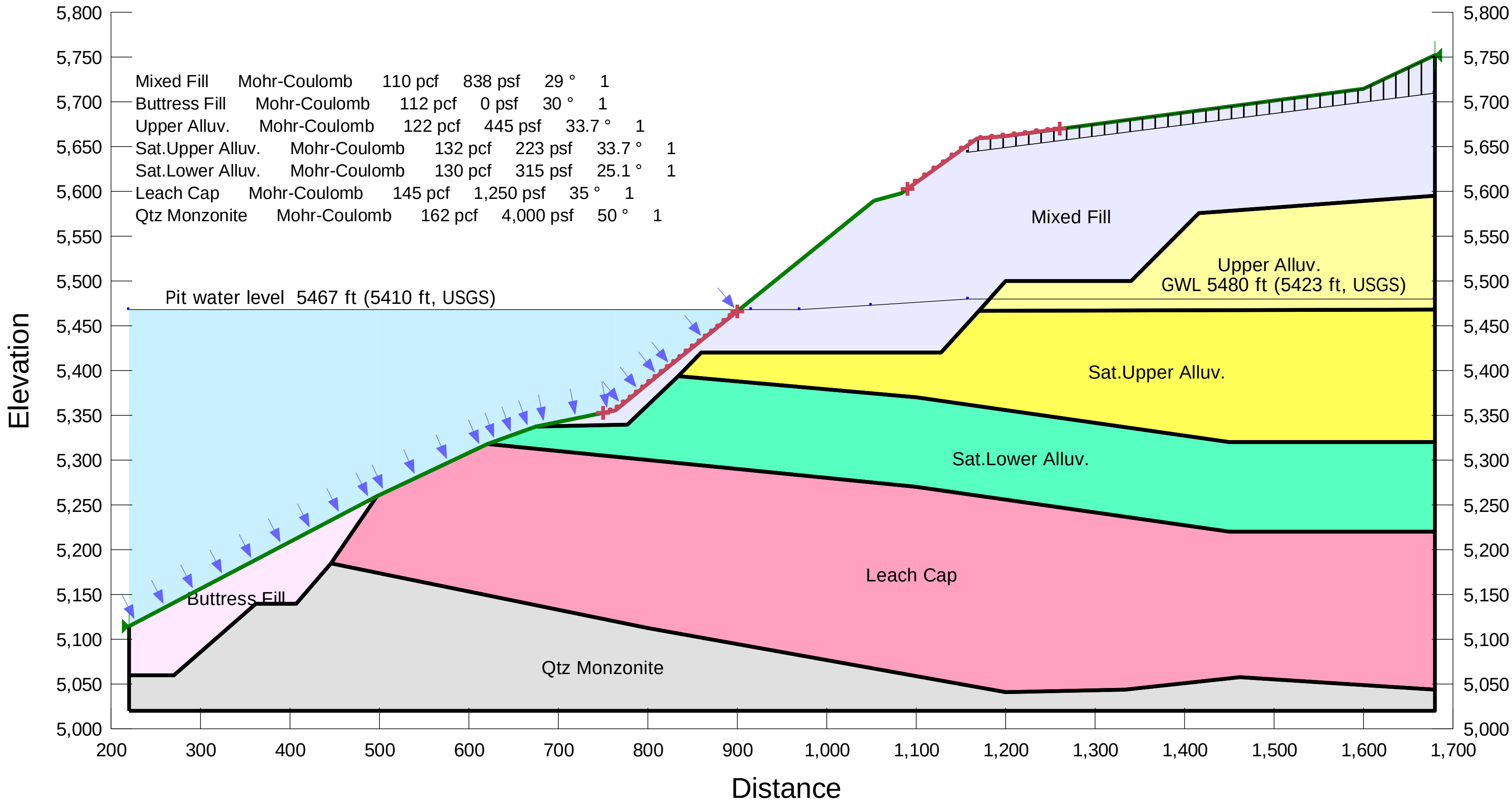
Scale as Shown; Anaconda Elev. Datum

June 2014 MI14010B Figure 2B

Pittsmont Sector: Cross-Section 383E N67W, Pit Water Level 5467 ft, Groundwater Level 5480 ft



Notes:
1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.

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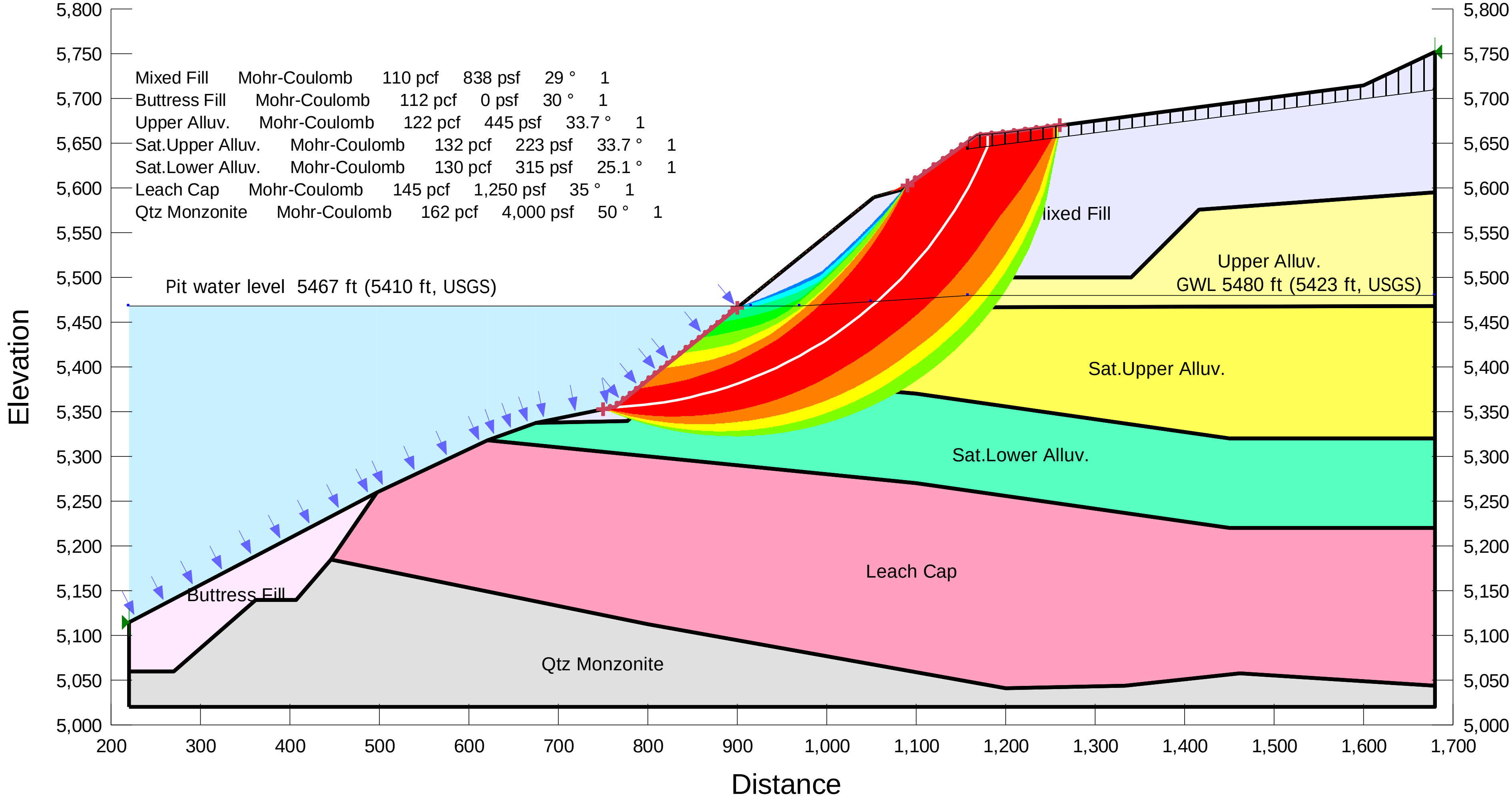
Scale as Shown; Anaconda Elev. Datum June 2014 MI14010B Figure 3

Pittsmont Sector: Cross-Section 383E N67W, Stability Analysis; Pit Water Level 5467 ft, Groundwater Level 5480 ft

Minimum Computed FOS for Mean Inputs 1.015



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.02.

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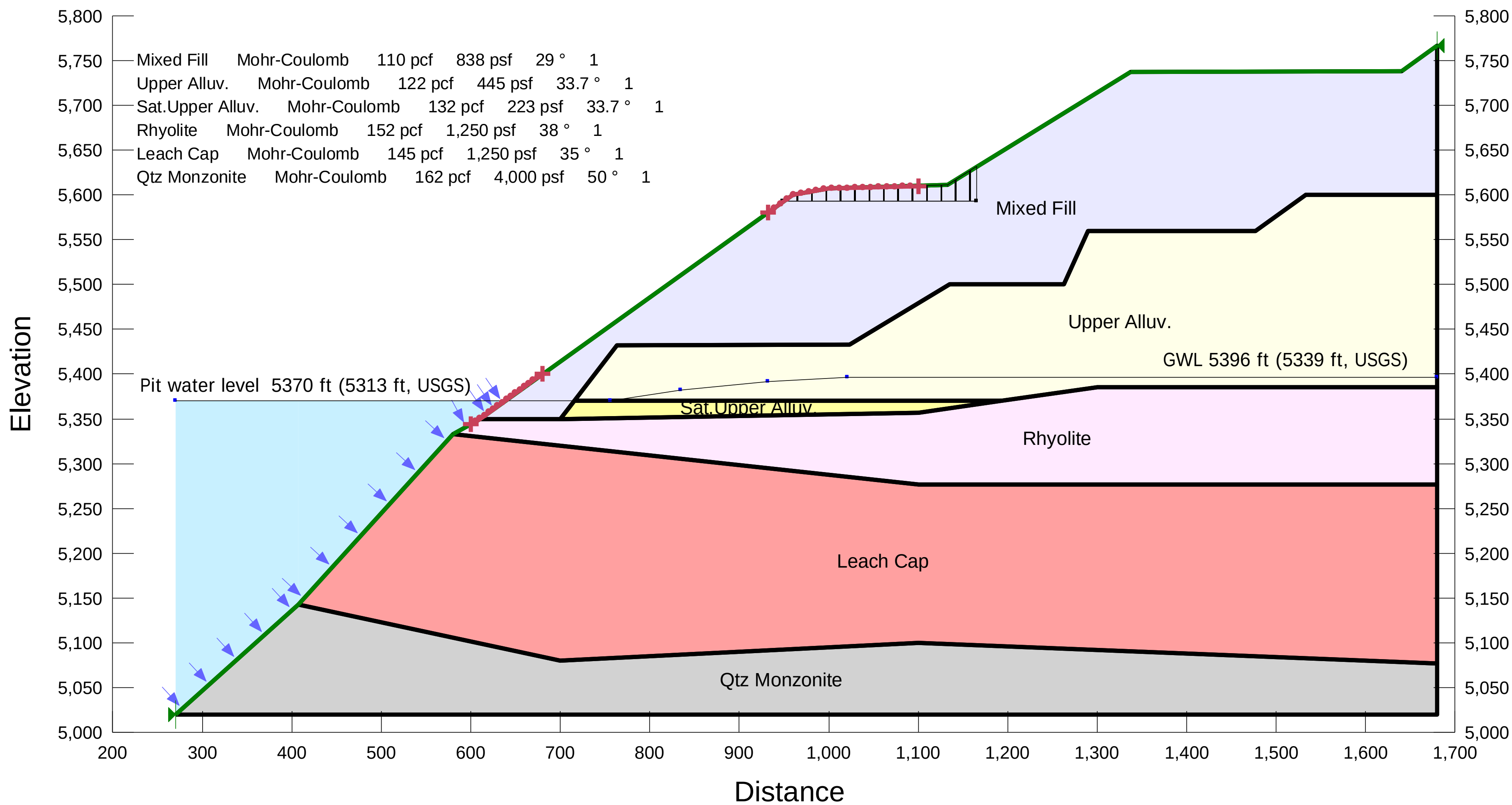
Scale as Shown; Anaconda Elev. Datum

June 2014 MI14010B Figure 3A

Pittsmont Sector: Cross-Section 385E N67W, Pit Water Level 5370 ft, Groundwater Level 5396 ft



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.

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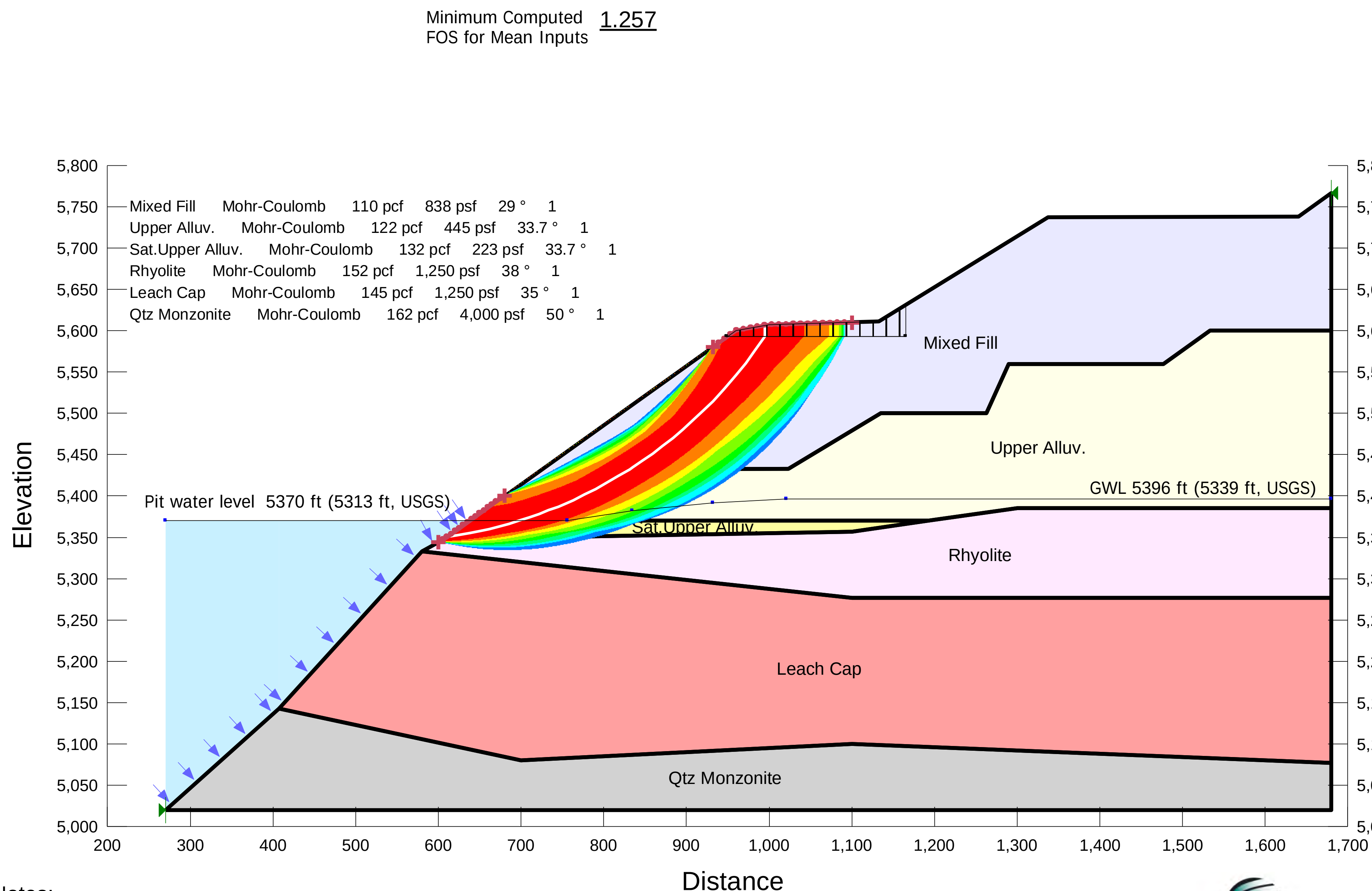
June 2014 MI14010B Figure 4

Pittsmont Sector: Cross-Section 385E N67W, Stability Analysis; Pit Water Level 5370 ft, Groundwater Level 5396 ft



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.05.

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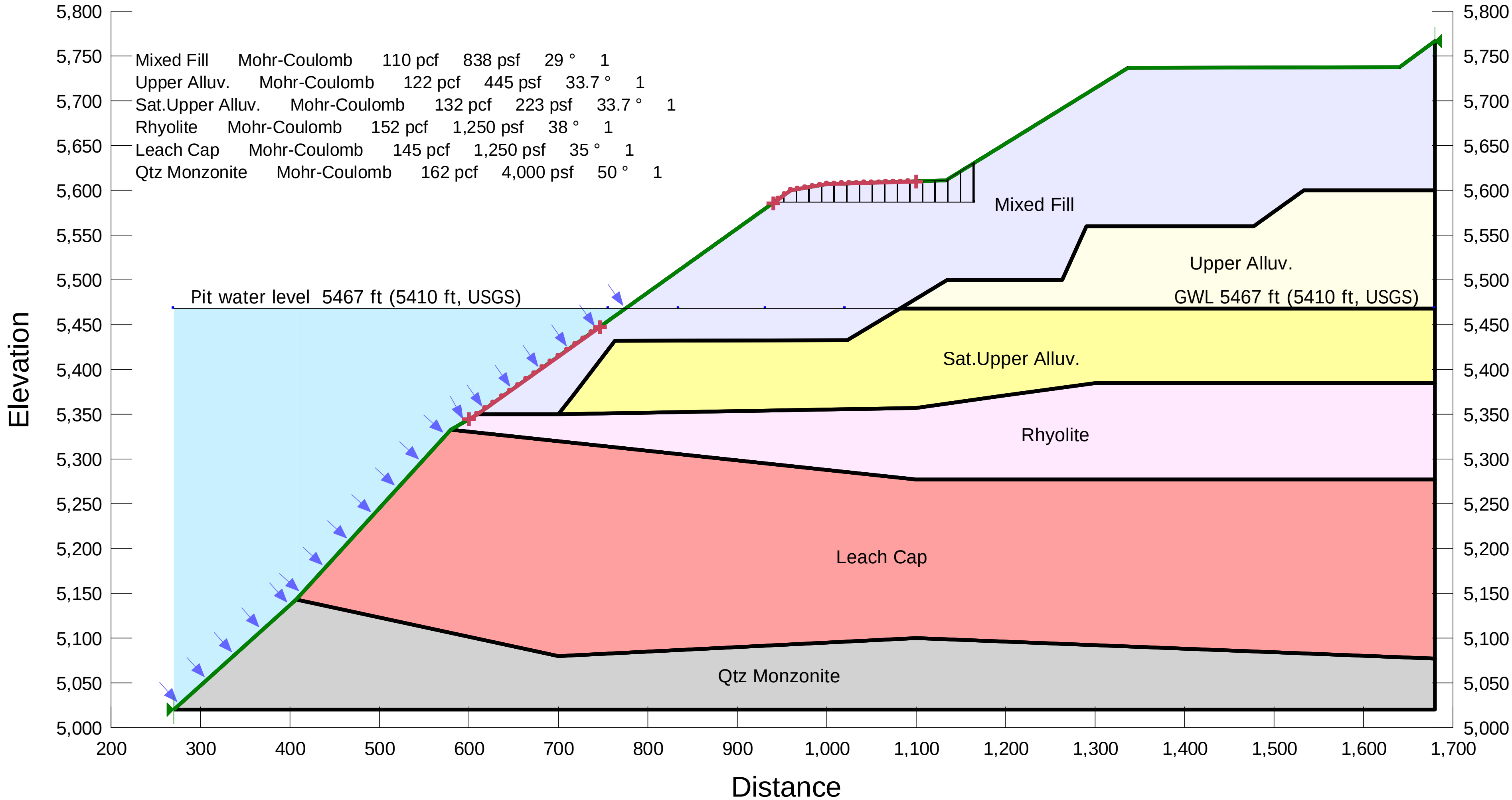
Scale as Shown; Anaconda Elev. Datum

June 2014 MI14010B Figure 4A

Pittsmont Sector: Cross-Section 385E N67W, Pit Water Level 5467 ft, Groundwater Level 5467 ft



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.

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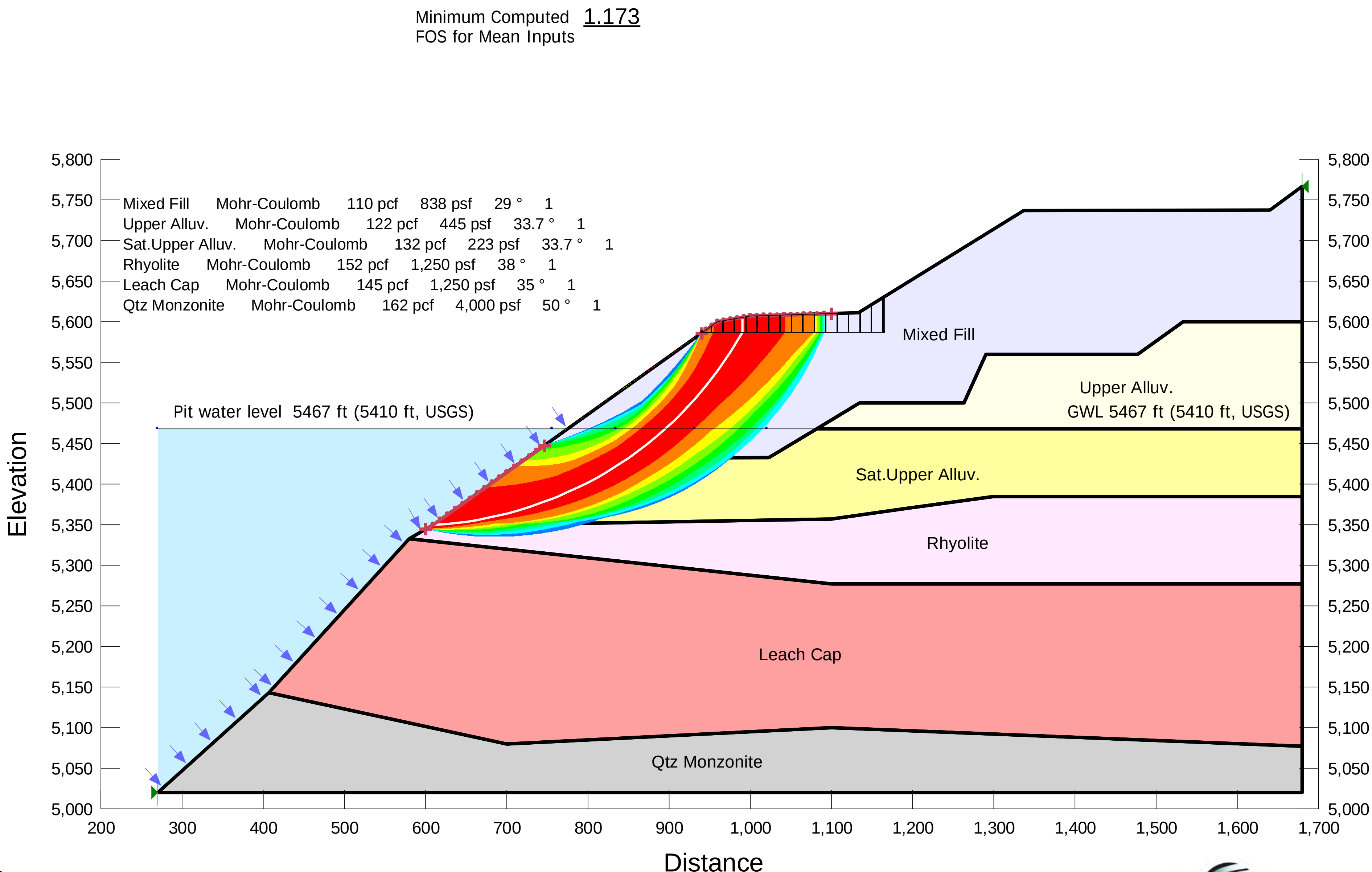
Scale as Shown; Anaconda Elev. Datum

June 2014 MI14010B Figure 5

Pittsmont Sector: Cross-Section 385E N67W, Stability Analysis; Pit Water Level 5467 ft, Groundwater Level 5467 ft



Notes:
1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.05.

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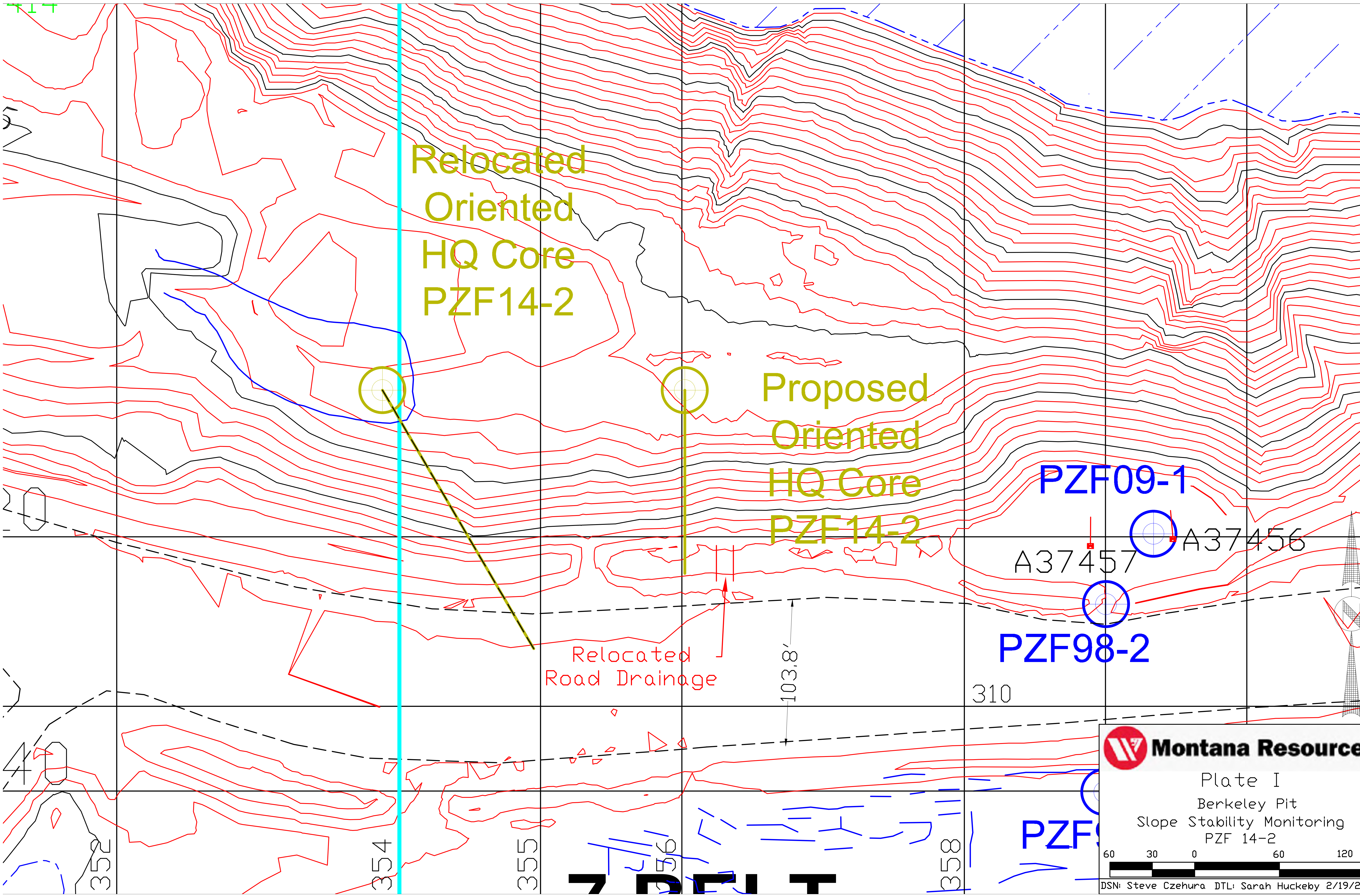
Scale as Shown; Anaconda Elev. Datum June 2014 MI14010B Figure 5A

TASK 3 – APPENDIX

Plate 1 and Plate 2



Relocated
Oriented
HQ Core
PZF14-2
Proposed
Oriented
HQ Core
PZF14-2
PZF09-1
A37456
A37457
PZF98-2
Relocated
Road Drainage
103.8'
310
352
354
355
356
358
Montana Resources
Plate I
Berkeley Pit
Slope Stability Monitoring
PZF 14-2
60
30
0
60
120 ft
DSN: Steve Czehura DTL: Sarah Huckeby 2/19/201

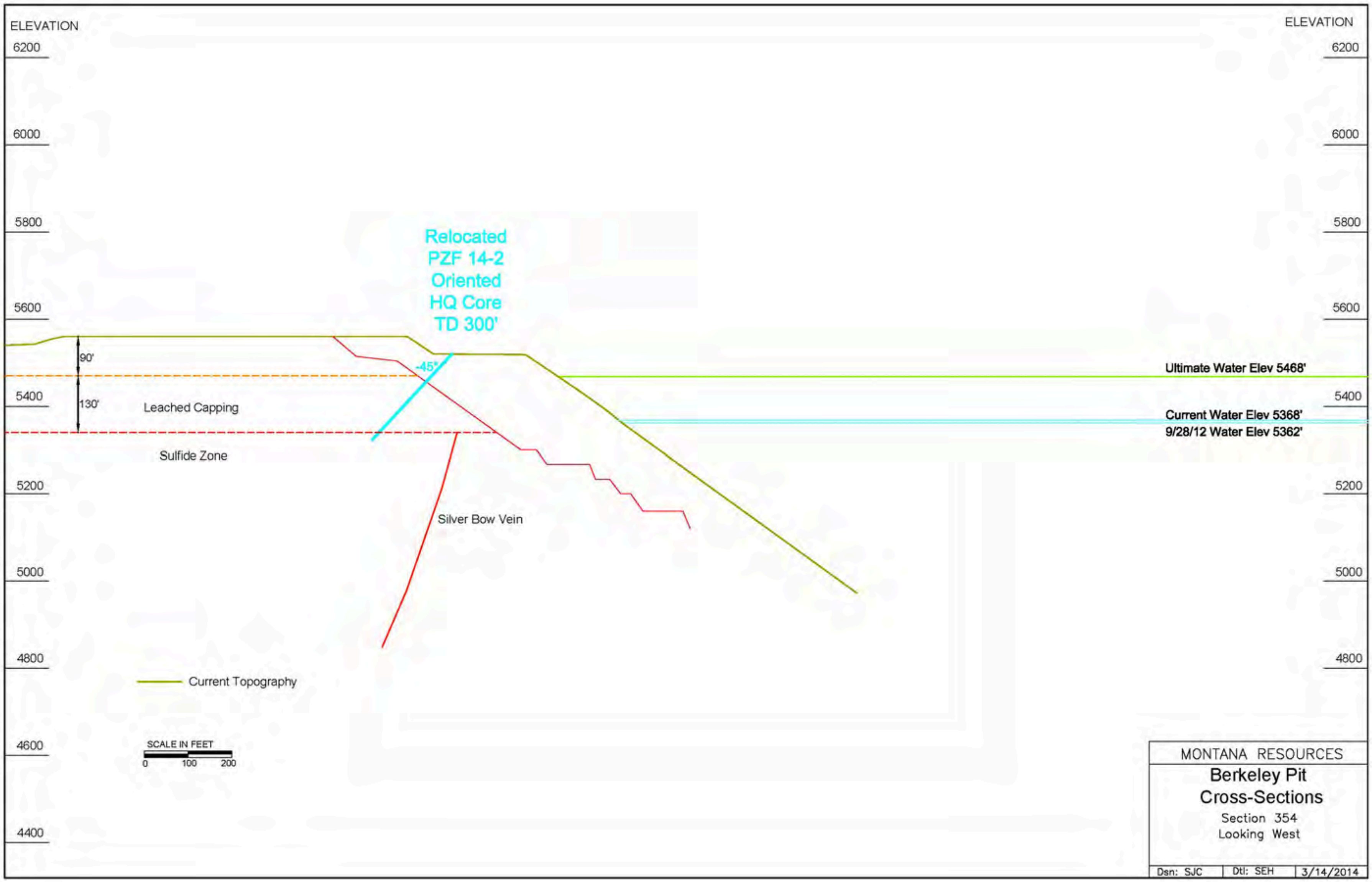


Plate 2. Proprosed location and inclination of Hole PZF14-2

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ATTACHMENT 1

Oriented Core Hole PZF14-2:

Core Logging Report

Stereonet Plots of Rock Discontinuity Orientations

Rock Discontinuity Set Information

Proj. No. MI14010C Hole No. PZF14-2 Core Size HQ3/ 2.45 in. By: SM Date: 2014 March 21-23

Butte, MT; Berkeley South Bearing 129.5 Plunge 47.2 Coords.: N00,00.0 W110,00.0 *DRAFT*

Drilling Interval(ft)						Rock Type		Discontinuity Information						Filling		Notes/	Orientation Results			
From	To	Recov	Recov (%)	RQD sum	RQD (%)	1	2	Type	Depth(ft)	T1/B0	Cir.Ang.	ACA	R	Type	Thk(mm)	Comments	Depth	Str	Dip Dir.	Dip
116	126	4	40	0.0	0	MFI										Mixed Fill; silty sand with gravel &				
126	131	4	80	0.0	0	MFI										weath. QMz cobbles 4 to 12 in.				
131	136	4	80	0.0	0	MFI										Wood frags. 131.5-132.5 ft				
136	141	5	100	0.9	18	MFI										Baggy sample 131.5-132.3ft				
141	146	5	100	1.4	28	MFI										Small wood fragment at 150.2 ft				
146	151	3.5	70	1.3	26	MFI										Baggy sample 150-150.7ft				
151	156	5	100	3.1	62	MFI	LC									QMz Leach Capping at 151 ft				
156	164	5.5	69	3.2	40	LC		JT	160.90	1	356	57	2	N		Intermittent gray weath. QMz and	160.90	1	62	65
156	164		69		40	LC		JT	160.95	1	62	38	2	N		red-brown FeO stained QMz;	160.95	1	291	67
156	164		69		40	LC		JT	161.20	1	163	25	2	N		soft and friable to intermed. Hard	161.20	1	87	37
156	164		69		40	LC		JT	162.00	0	149	27	2	N			162.00	1	153	82
156	164		69		40	LC		JT	163.80	1	33	57	2	N			163.80	1	265	85
164	174	10	100	6.4	64	LC		JT	165.50	1	234	12	2	N			165.50	1	302	78
164	174		100		64	LC		FT	165.60	0	286	23	0	N		Slickensides	165.60	2	317	58
164	174		100		64	LC		JT	165.70	0	51	66	3	N			165.70	1	250	42
164	174		100		64	LC		JT	166.20	0	33	46	2	CY		Core sample 168-168.5ft (UCS)	166.20	1	214	37
164	174		100		64	LC		JT	168.70	1	157	67	3	N			168.70	1	39	58
164	174		100		64	LC		JT	168.80	0	72	36	2	N			168.80	1	288	30
164	174		100		64	LC		JT	169.40	1	171	42	3	N			169.40	1	73	52
164	174		100		64	LC		JT	169.60	0	29	35	2	N			169.60	1	198	33
164	174		100		64	LC		JT	169.80	1	150	48	2	N			169.80	1	47	40
164	174		100		64	LC		JT	169.95	0	36	67	3	N			169.95	1	232	50
164	174		100		64	LC		JT	170.00	0	22	38	3	N			170.00	1	193	40
164	174		100		64	LC		JT	170.60	0	209	76	2	N			170.60	1	231	60
164	174		100		64	LC		JT	170.65	0	342	20	2	N			170.65	1	150	68
164	174		100		64	LC		JT	170.90	1	211	39	2	N			170.90	1	97	86
164	174		100		64	LC		FT	172.60	0	129	16	0	N		Slickensides	172.60	2	320	81
164	174		100		64	LC		JT	172.90	0	232	18	2	N			172.90	1	249	13
164	174		100		64	LC		JT	172.95	1	273	27	2	N			172.95	1	312	40
164	174		100		64	LC		FT	173.10	1	128	17	0	CY		Slickensides	173.10	2	10	12
164	174		100		64	LC		FT	173.80	0	30	21	0	CY		Slickensides	173.80	2	180	24
174	182	7.3	91	3.1	39	LC		JT	175.60	1	214	44	2	N		Core sample 175.2-175.8ft (DS)	175.60	1	274	90
174	182		91		39	LC		JT	175.65	1	103	62	2	N			175.65	1	328	38
174	182		91		39	LC		JT	176.30	0	34	52	1	N			176.30	1	220	41
174	182		91		39	LC		FT	176.40	0	292	29	0	N		Slickensides	176.40	1	321	63

174	182		91		39	LC		FT	176.80	0	84	19	0	N		Slickensides	176.80	1	306	37
174	182		91		39	LC		FT	179.30	1	141	34	0	CY		Slickensides	179.30	1	45	26
174	182		91		39	LC		JT	179.45	1	178	30	2	CY			179.45	1	90	52
174	182		91		39	LC		JT	179.70	0	340	46	2	N			179.70	1	173	79
174	182		91		39	LC		JT	179.85	1	321	57	2	CY			179.85	1	29	41
174	182		91		39	LC		JT	180.40	1	192	73	2	N			180.40	1	60	88
174	182		91		39	LC		JT	180.80	1	129	34	1	CY			180.80	1	17	22
174	182		91		39	LC		JT	181.00	1	257	78	2	CY			181.00	1	292	47
174	182		91		39	LC		JT	181.30	0	340	63	2	CY			181.30	1	186	88
182	186	4	100	3.5	88	LC		FT	182.40	1	198	35	0	N		Slickensides	182.40	1	95	72
182	186		100		88	LC		JT	183.35	1	291	81	2	N		Core sample 182-182.8ft (DS)	183.35	1	340	44
182	186		100		88	LC		JT	183.80	1	190	38	3	N			183.80	1	88	66
182	186		100		88	LC		JT	183.95	0	274	58	2	N			183.95	1	314	45
182	186		100		88	LC		FT	184.65	0	268	64	0	CY		Slickensides	184.65	1	307	42
182	186		100		88	LC		FT	184.90	1	272	65	1	CY		Slickensides	184.90	1	312	42
182	186		100		88	LC		JT	185.80	0	333	29	2	CY			185.80	1	156	79
186	196	10	100	7.9	79	LC		JT	187.50	1	182	48	1	CY			187.50	1	74	65
186	196		100		79	LC		FT	188.20	0	311	25	0	N		Slickensides	188.20	1	326	81
186	196		100		79	LC		JT	189.50	1	328	27	2	N			189.50	1	66	26
186	196		100		79	LC		JT	189.90	0	309	16	1	CY			189.90	1	320	81
186	196		100		79	LC		FT	190.15	1	12	58	0	N		Slickensides	190.15	1	72	78
186	196		100		79	LC		JT	190.35	1	342	57	2	N		Core sample 190.5-191.2ft (UCS)	190.35	1	52	55
186	196		100		79	LC		JT	191.00	0	92	62	2	N			191.00	1	312	44
186	196		100		79	LC		JT	191.80	0	268	64	2	N			191.80	1	307	42
186	196		100		79	LC		JT	191.85	0	39	60	2	N			191.85	1	231	43
186	196		100		79	LC		JT	192.30	1	203	72	2	N			192.30	1	248	85
186	196		100		79	LC		JT	193.40	0	262	24	2	N			193.40	1	304	36
186	196		100		79	LC		JT	193.50	0	324	37	2	N			193.50	1	159	90
186	196		100		79	LC		JT	193.85	1	281	32	1	N			193.85	1	320	34
186	196		100		79	LC		JT	195.20	1	206	57	2	N			195.20	1	81	89
186	196		100		79	LC		JT	195.60	0	347	44	3	N			195.60	1	175	72
186	196		100		79	LC		JT	196.00	0	348	53	3	N			196.00	1	183	76
196	204.5	8.5	100	7.3	86	LC		FT	197.40	1	177	40	0	N		Slickensides	197.40	1	79	56
196	204.5		100		86	LC		JT	198.00	0	217	44	2	N			198.00	1	218	34
196	204.5		100		86	LC		JT	198.10	1	215	27	3	N			198.10	1	108	86
196	204.5		100		86	LC		JT	198.20	1	219	38	3	N			198.20	1	281	87
196	204.5		100		86	LC		JT	199.15	0	199	33	2	N			199.15	1	184	39
196	204.5		100		86	QMZ		JT	199.30	1	352	34	1	N		Gray quartz monzonite at 199.3 ft	199.30	1	82	49

196	204.5		100		86	QMZ		JT	200.40	1	351	45	3	N			200.40	1	70	54
196	204.5		100		86	QMZ		JT	201.10	0	324	35	1	CY	3.0		201.10	1	157	89
196	204.5		100		86	QMZ		JT	201.95	0	217	41	1	N			201.95	1	216	32
196	204.5		100		86	DK		CT	203.20	1	320	28	2	N		Dark gray fine-gr dike 203.2 to 203.8ft	203.20	3	49	21
196	204.5		100		86	DK		CT	203.80	0	192	46	0	CY	2.0	Slickensides	203.80	3	193	52
196	204.5		100		86	QMZ		JT	203.95	1	214	60	2	N			203.95	1	263	83
204.5	210.5	6	100	3.1	52	QMZ		JT	204.70	1	258	33	2	N			204.70	1	301	53
204.5	210.5		100		52	QMZ		JT	205.25	0	36	51	2	CY			205.25	1	222	39
204.5	210.5		100		52	QMZ		JT	207.00	1	61	29	2	N			207.00	1	295	69
204.5	210.5		100		52	QMZ		FT	208.80	1	154	33	0	CY		Slickensides; 208-208.8ft fault zone	208.80	2	67	34
204.5	210.5		100		52	QMZ		JT	209.00	0	231	35	2	CY			209.00	1	242	23
204.5	210.5		100		52	QMZ		JT	209.00	0	30	58	2	N			209.00	1	220	47
204.5	210.5		100		52	QMZ		JT	209.40	0	212	42	2	CY		209.6-210.0ft dark grn to black zone	209.40	1	209	35
210.5	216	5.5	100	3.3	60	QMZ		JT	210.90	1	183	43	2	CY			210.90	1	79	63
210.5	216		100		60	QMZ		JT	211.60	0	92	33	2	N			211.60	1	311	44
210.5	216		100		60	QMZ		JT	211.90	1	209	55	1	N		Core sample 211.6-212.2ft (DS)	211.90	1	264	89
210.5	216		100		60	QMZ		JT	212.20	0	201	69	2	CY			212.20	1	219	61
216	219.5	3.5	100	1.3	37	QMZ		JT	217.00	1	354	28	2	N			217.00	1	90	48
216	219.5		100		37	QMZ		JT	217.20	0	187	42	2	N			217.20	1	185	54
216	219.5		100		37	QMZ		JT	217.55	0	155	34	2	N		218.6-219.5ft rubble zone	217.55	1	161	78
219.5	226	6.5	100	3.4	52	QMZ		JT	219.95	1	261	43	2	N			219.95	1	301	50
219.5	226		100		52	QMZ		JT	220.50	1	340	53	2	N		Core sample 220.5-221.2ft (UCS)	220.50	1	53	51
219.5	226		100		52	QMZ		JT	222.50	1	298	51	2	N		Begin QM enrichment zone at 223ft	222.50	1	353	32
219.5	226		100		52	QME		JT	223.00	0	228	38	2	CL		(lacks biotite in fabric)	223.00	1	235	25
219.5	226		100		52	QME		JT	225.30	1	198	28	2	CL		223.5-224.6ft dark gry to black zone	225.30	1	101	70
219.5	226		100		52	QME		JT	225.65	0	47	65	2	N			225.65	1	244	43
219.5	226		100		52	QME		JT	226.00	0	32	81	2	N			226.00	1	237	61
226	231.5	5.5	100	2.2	40	QME		JT	226.60	0	167	43	2	CY		227.3-228.1ft Silica-rich/quartz (vein?)	226.60	1	174	71
226	231.5		100		40	QME		FT	228.90	0	18	28	1	CY		228.6-229.5ft fault zone	228.90	2	177	37
226	231.5		100		40	QME		JT	229.50	1	306	44	1	CY			229.50	1	9	28
231.5	236	4.5	100	3.4	76	QME		JT	232.50	0	29	62	2	N		Core sample 232.5-233.1ft (UCS)	232.50	1	222	51
231.5	236		100		76	QME		FT	233.20	0	193	48	0	CY		Slickensides	233.20	2	195	53
231.5	236		100		76	QME		JT	233.50	1	322	37	2	CY			233.50	1	45	28
231.5	236		100		76	QME		JT	233.70	1	68	38	2	N			233.70	1	294	60
231.5	236		100		76	QME		JT	234.45	0	131	40	2	N			234.45	1	335	78
231.5	236		100		76	QME		JT	235.00	0	219	22	3	N			235.00	1	200	18
231.5	236		100		76	QME		JT	235.10	0	112	71	1	N			235.10	1	336	53
231.5	236		100		76	QME		JT	235.40	0	220	21	2	N			235.40	1	202	17

231.5	236		100		76	QME		JT	235.50	0	172	23	2	N			235.50	1	156	59
236	243.5	7.5	100	4.2	56	QME		JT	236.50	1	62	34	1	CY		Calcite crystals 2-5mm on surface	236.50	1	293	67
236	243.5		100		56	QME		JT	238.40	1	110	24	1	CY			238.40	1	328	26
236	243.5		100		56	QME		JT	238.60	0	282	29	2	N			238.60	1	316	54
236	243.5		100		56	QME		JT	238.80	1	118	37	1	CY	2.0		238.80	1	351	25
236	243.5		100		56	QME		JT	239.25	0	311	28	2	CY			239.25	1	328	81
236	243.5		100		56	QME		FT	239.60	0	309	35	0	CY		Slickensides	239.60	2	331	77
236	243.5		100		56	QME	QMZ	FT	240.20	0	237	30	0	CY	2.0	Slickensides	240.20	2	259	21
236	243.5		100		56	QMZ		JT	241.30	0	122	30	2	N		Gray QMz with biotite	241.30	1	326	72
236	243.5		100		56	QMZ		JT	241.60	1	327	43	2	N			241.60	1	47	35
236	243.5		100		56	QMZ		JT	241.85	1	48	9	1	CY	1.0		241.85	1	303	84
236	243.5		100		56	QMZ		JT	242.25	1	109	59	3	N			242.25	1	338	36
236	243.5		100		56	QMZ		JT	243.20	0	264	43	3	N			243.20	1	303	39
243.5	246	2.5	100	1.2	48	QMZ		JT	243.65	1	258	31	2	N			243.65	1	302	53
243.5	246		100		48	QMZ		JT	244.60	0	126	8	1	CY			244.60	1	314	79
243.5	246		100		48	QMZ		JT	244.80	0	30	51	2	N			244.80	1	214	43
243.5	246		100		48	QMZ		FT	245.30	0	286	10	0	CY		Slickensides	245.30	2	313	59
243.5	246		100		48	QMZ		JT	245.80	1	293	60	1	N			245.80	1	345	36
246	256	10	100	7.4	74	QMZ		JT	248.10	0	338	40	1	CY	2.0		248.10	1	167	78
246	256		100		74	QMZ		JT	248.35	0	16	47	2	N			248.35	1	197	50
246	256		100		74	QMZ		JT	249.30	1	168	66	2	N			249.30	1	49	65
246	256		100		74	QMZ		JT	249.90	0	356	46	2	N			249.90	1	182	65
246	256		100		74	QMZ		JT	250.10	1	80	44	2	N			250.10	1	300	50
246	256		100		74	QMZ		JT	250.60	1	198	67	2	N			250.60	1	68	89
246	256		100		74	QMZ		JT	251.35	0	354	58	3	N			251.35	1	191	74
246	256		100		74	QMZ		JT	253.30	1	178	53	1	N			253.30	1	67	64
246	256		100		74	QMZ		JT	253.35	1	127	33	2	N			253.35	1	12	22
246	256		100		74	QMZ		JT	253.60	0	5	57	2	N			253.60	1	197	64
246	256		100		74	QMZ		JT	253.90	0	122	38	2	N			253.90	1	330	70
246	256		100		74	QMZ		JT	254.25	1	77	45	2	N			254.25	1	298	53
256	262	6	100	3.7	62	QMZ		JT	257.35	1	112	35	1	N			257.35	1	337	27
256	262		100		62	QMZ		JT	257.40	1	9	26	3	N			257.40	1	100	61
256	262		100		62	QMZ		JT	257.80	0	5	21	2	N			257.80	1	159	46
256	262		100		62	QMZ		JT	257.90	0	283	30	2	N			257.90	1	317	54
256	262		100		62	QMZ		JT	257.95	0	149	45	2	N			257.95	1	167	88
256	262		100		62	QMZ		FT	259.90	1	47	18	0	CY		Slickensides; fault thickness 4 in.	259.90	2	297	84
256	262		100		62	QMZ		JT	261.00	1	226	52	2	N			261.00	1	275	76
256	262		100		62	QMZ		JT	261.10	1	334	30	1	CY	1.0		261.10	1	71	32

256	262		100		62	QMZ		JT	261.90	0	355	20	2	N			261.90	1	154	55
262	266	4	100	3.1	78	QMZ		JT	262.85	0	80	43	2	N			262.85	1	298	36
262	266		100		78	QMZ		JT	262.90	0	79	48	2	N			262.90	1	296	36
262	266		100		78	QMZ		JT	263.70	1	330	27	1	CY	3.0		263.70	1	69	27
262	266		100		78	QMZ		JT	264.20	0	133	72	1	N			264.20	1	354	67
262	266		100		78	QMZ		JT	264.45	1	326	37	2	CY	2.0		264.45	1	51	31
262	266		100		78	QMZ		JT	264.60	1	43	56	3	N			264.60	1	271	77
262	266		100		78	QMZ		JT	265.20	0	356	24	2	N			265.20	1	159	55
266	270	4	100	1.7	43	QMZ		JT	266.25	0	235	52	2	N			266.25	1	253	33
266	270		100		43	QMZ		JT	266.80	1	11	47	0	CY		Slickensides; fault thickness 3 in.	266.80	1	80	72
266	270		100		43	QMZ		JT	267.80	0	160	37	1	CY			267.80	1	165	75
266	270		100		43	QMZ		JT	268.15	1	42	48	2	CY			268.15	1	276	81
266	270		100		43	QMZ		JT	268.50	0	166	62	2	N			268.50	1	189	82
266	270		100		43	QMZ		JT	269.40	0	161	34	1	CY			269.40	1	163	73
266	270		100		43	QMZ		JT	269.75	1	197	30	2	N			269.75	1	99	70
270	276	6	100	4.9	82	QMZ		JT	271.00	1	345	53	2	N		Harder QMz with cleaner fracs	271.00	1	58	54
270	276		100		82	QMZ		JT	271.10	1	268	37	1	N			271.10	1	308	44
270	276		100		82	QMZ		JT	271.40	0	209	42	2	N			271.40	1	205	37
270	276		100		82	QMZ		JT	271.75	1	178	45	2	N			271.75	1	74	60
270	276		100		82	QMZ		JT	273.20	1	162	49	2	N			273.20	1	59	49
270	276		100		82	QMZ		JT	273.40	0	247	32	2	N			273.40	1	281	26
270	276		100		82	QMZ		JT	273.50	0	138	44	1	N			273.50	1	341	83
270	276		100		82	QMZ		JT	273.65	1	286	38	1	CY	1.0		273.65	1	328	31
270	276		100		82	QMZ		JT	273.80	1	276	35	2	N			273.80	1	315	38
270	276		100		82	QMZ		JT	273.95	0	54	38	1	CY			273.95	1	250	25
270	276		100		82	QMZ		JT	274.80	1	170	48	2	N			274.80	1	66	55
270	276		100		82	QMZ		JT	275.80	0	206	30	2	N			275.80	1	188	32
276	280.5	4.5	100	3.7	82	QMZ		JT	276.70	1	139	43	2	N			276.70	1	35	31
276	280.5		100		82	QMZ		JT	277.30	0	58	37	2	N			277.30	1	259	25
276	280.5		100		82	QMZ		JT	277.75	0	185	37	2	N			277.75	1	178	53
276	280.5		100		82	QMZ		JT	278.20	0	181	36	1	CY/PY	10.0	Clay & pyrite filling	278.20	1	175	56
276	280.5		100		82	QMZ		JT	278.70	0	182	30	2	PY			278.70	1	169	52
276	280.5		100		82	QMZ		JT	278.85	1	5	34	1	N			278.85	1	90	60
276	280.5		100		82	QMZ		JT	279.30	0	239	41	1	N			279.30	1	261	27
276	280.5		100		82	QMZ		JT	279.50	1	323	36	1	CY	1.0		279.50	1	47	28
276	280.5		100		82	QMZ		JT	279.90	0	179	20	1	N			279.90	1	155	51
276	280.5		100		82	QMZ		JT	280.10	1	148	53	2	N			280.10	1	41	43
276	280.5		100		82	QMZ		FT	280.20	1	355	26	0	CY		Slickensides; fault thickness 1.2 in.	280.20	2	93	48

280.5	286	5.5	100	4.4	80	QMZ		JT	280.80	1	186	48	2	N			280.80	1	77	68
280.5	286		100		80	QMZ		JT	281.95	1	157	39	2	N			281.95	1	64	39
280.5	286		100		80	QMZ		JT	282.45	0	304	45	2	N			282.45	1	334	70
280.5	286		100		80	QMZ		JT	283.40	0	3	50	3	CY			283.40	1	190	62
280.5	286		100		80	QMZ		JT	283.45	1	80	46	2	N			283.45	1	300	51
280.5	286		100		80	QMZ		JT	284.50	1	173	40	2	CY			284.50	1	76	53
280.5	286		100		80	QMZ		JT	285.15	0	325	39	2	N			285.15	1	161	89
280.5	286		100		80	QMZ		JT	285.60	0	308	19	3	N			285.60	1	321	79
280.5	286		100		80	QMZ		JT	285.85	0	153	42	2	CY/PY			285.85	1	166	83
286	293.5	6.9	92	4.6	61	QMZ		JT	286.80	0	185	41	2	N			286.80	1	183	55
286	293.5		92		61	QMZ		JT	287.00	1	220	47	2	N			287.00	1	275	83
286	293.5		92		61	QMZ		JT	287.40	0	67	29	3	N			287.40	1	283	25
286	293.5		92		61	QMZ		JT	288.00	1	320	32	2	CY	2.0		288.00	1	45	24
286	293.5		92		61	QMZ	QME	FT	288.40	0	219	36	0	CY	5.0	Slickensides	288.40	2	215	27
286	293.5		92		61	QME		JT	289.40	1	237	54	2	CY		QME (lacking biotite)	289.40	1	281	67
286	293.5		92		61	QME		JT	289.90	0	296	68	1	CY			289.90	1	339	57
286	293.5		92		61	QME		JT	290.80	1	235	46	2	N			290.80	1	284	71
286	293.5		92		61	QME		JT	291.80	0	299	34	2	N			291.80	1	326	68
286	293.5		92		61	QME		FT	292.20	1	68	38	1	CY/PY		Slickensides; fault thickness 1.5 in.	292.20	2	294	61
																Total Depth of Hole: 293.5 ft				

Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

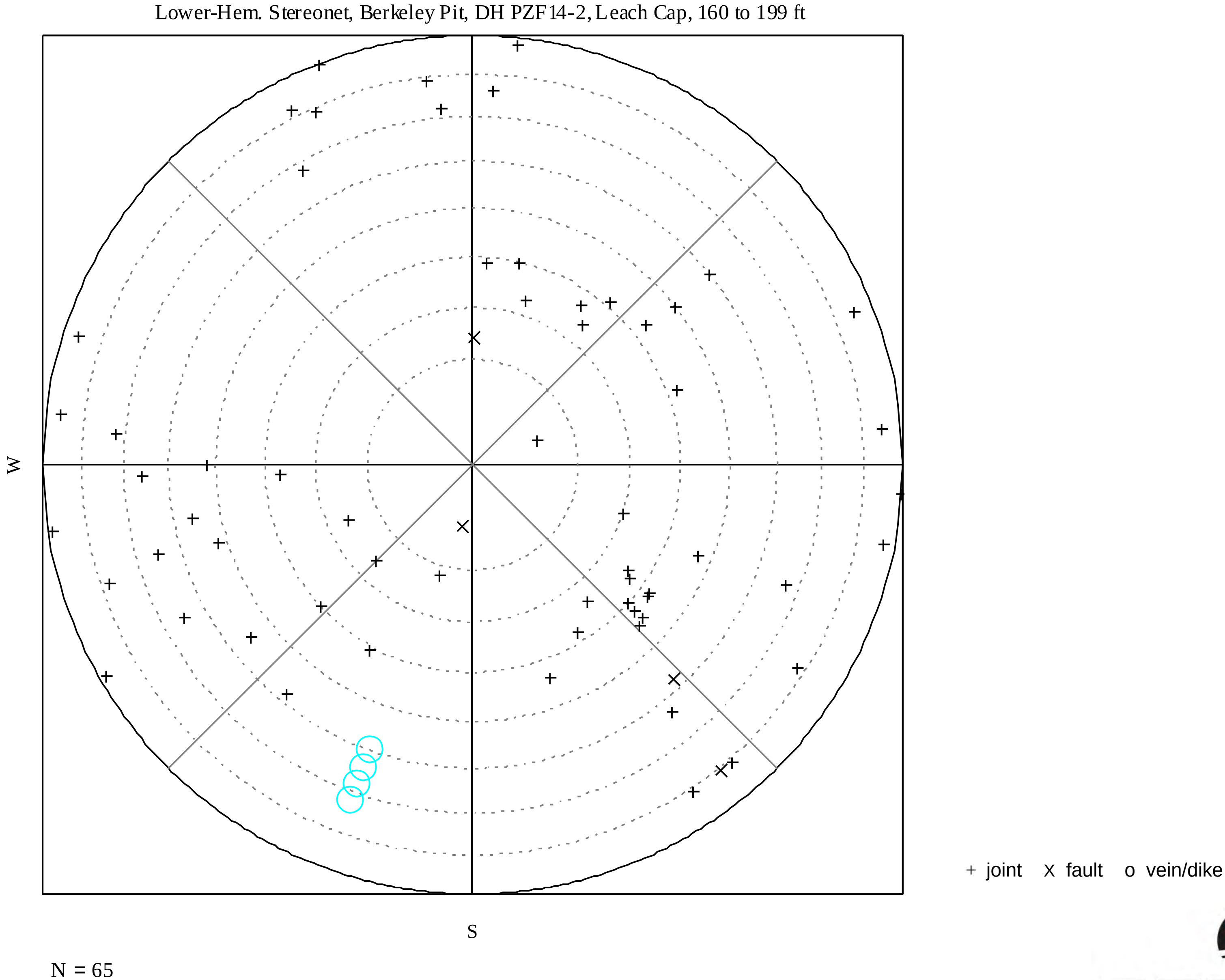

Figure A1. Leach Capping, 160 to 199 ft: Rock Discontinuity Orientations.

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Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

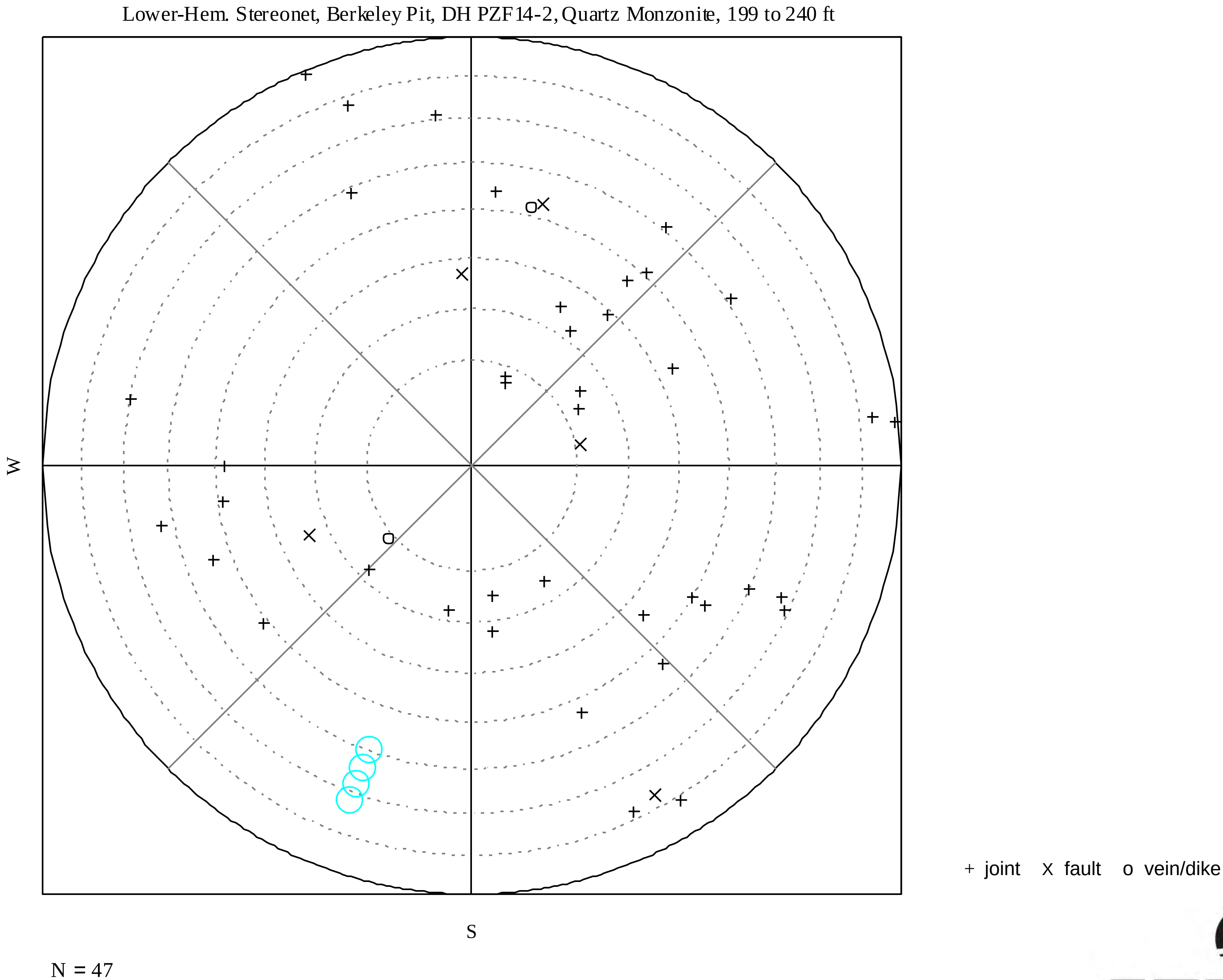

Figure A2. Quartz Monzonite, 199 to 240 ft: Rock Discontinuity Orientations.

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Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

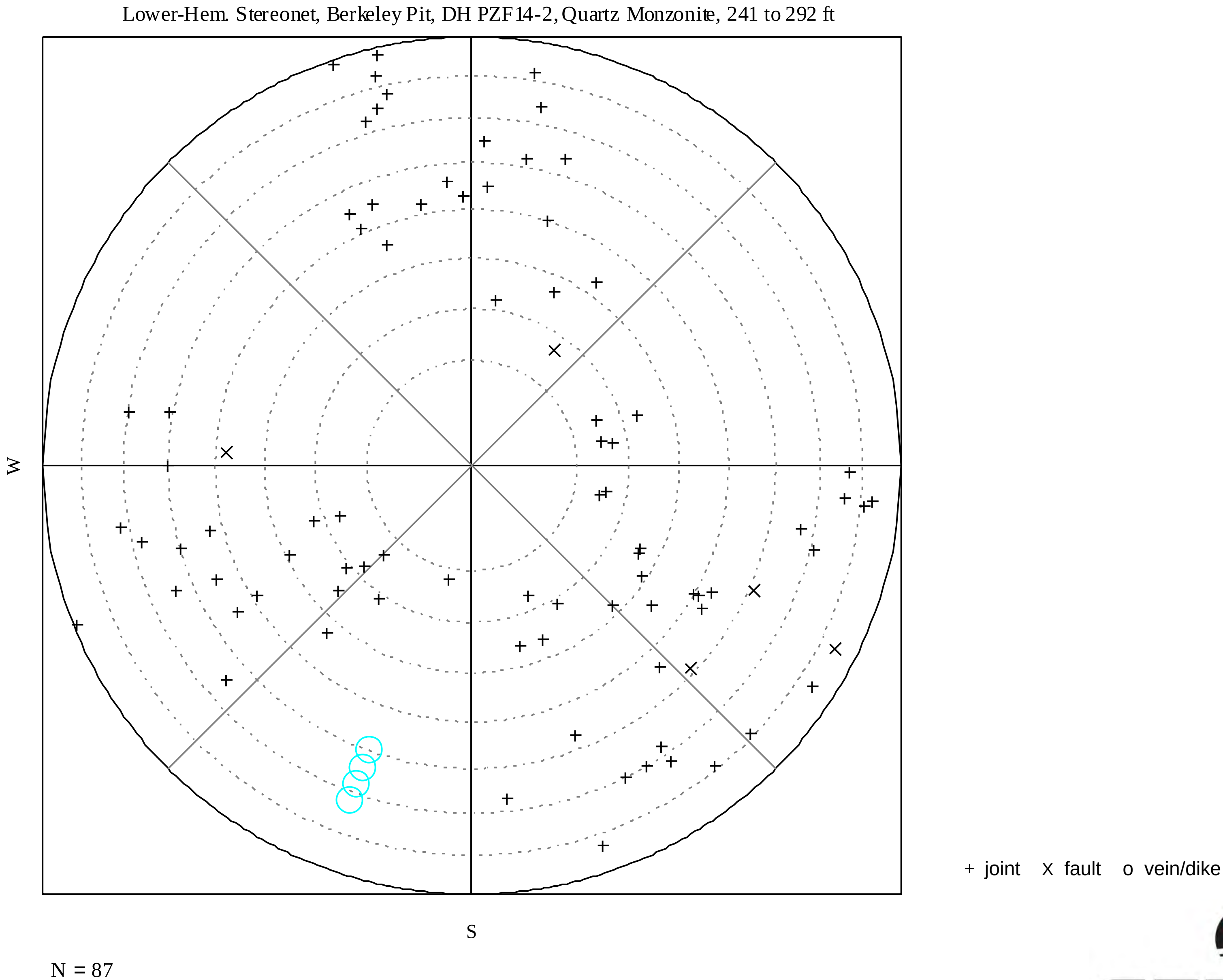

Figure A3. Quartz Monzonite, 241 to 292 ft: Rock Discontinuity Orientations.

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Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

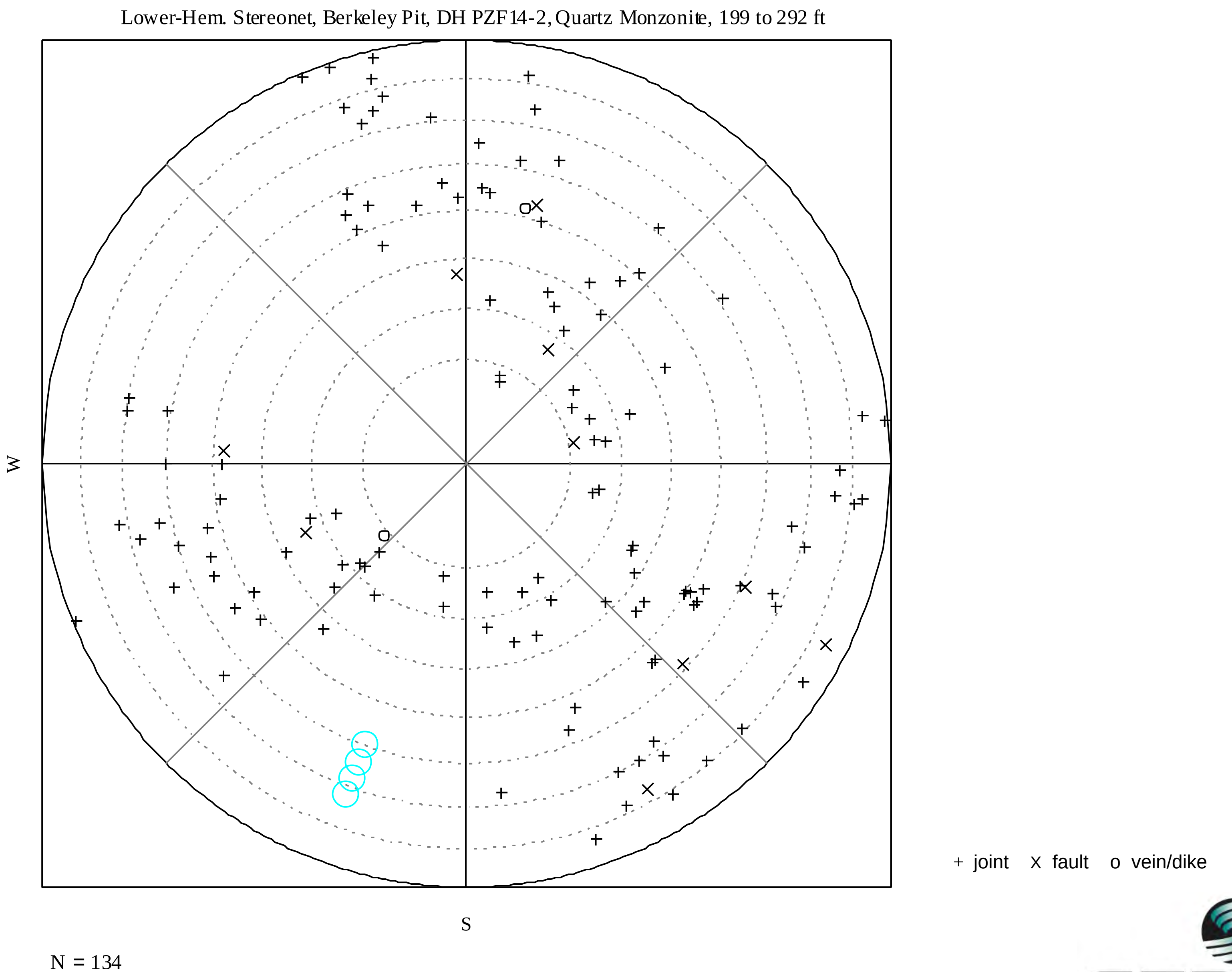

Figure A4. Quartz Monzonite, 199 to 292 ft: Rock Discontinuity Orientations.

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Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

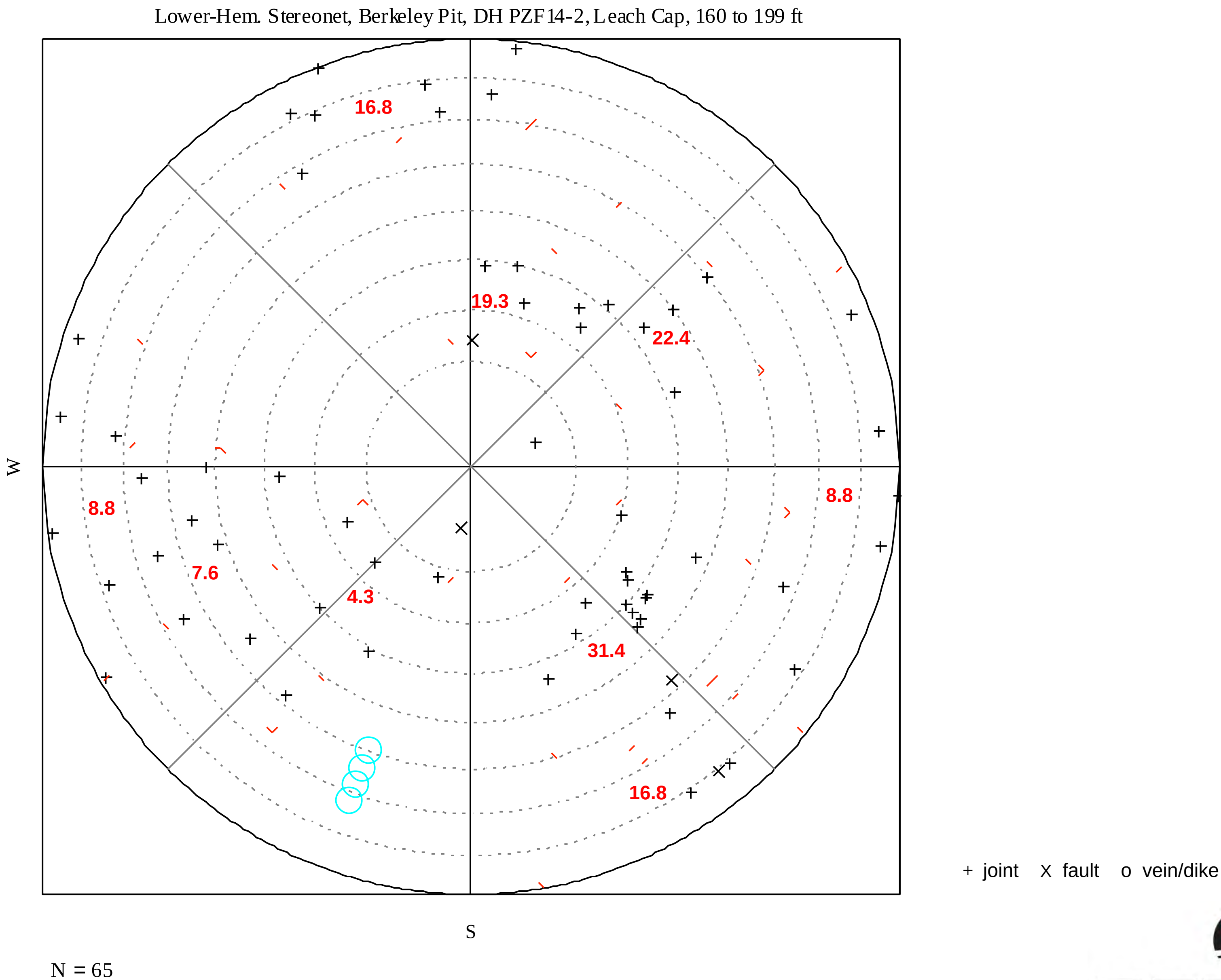

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Figure A5. Leach Capping, Rock Discontinuity Sets: DH PZF14-2, 160 to 199 ft.

MI14010C

Berkeley Pit Concentrator Sector: STRATA Oriented Core Logging of Rock Discontinuities
Lower-Hemisphere Stereonet Plot of Poles to Structures

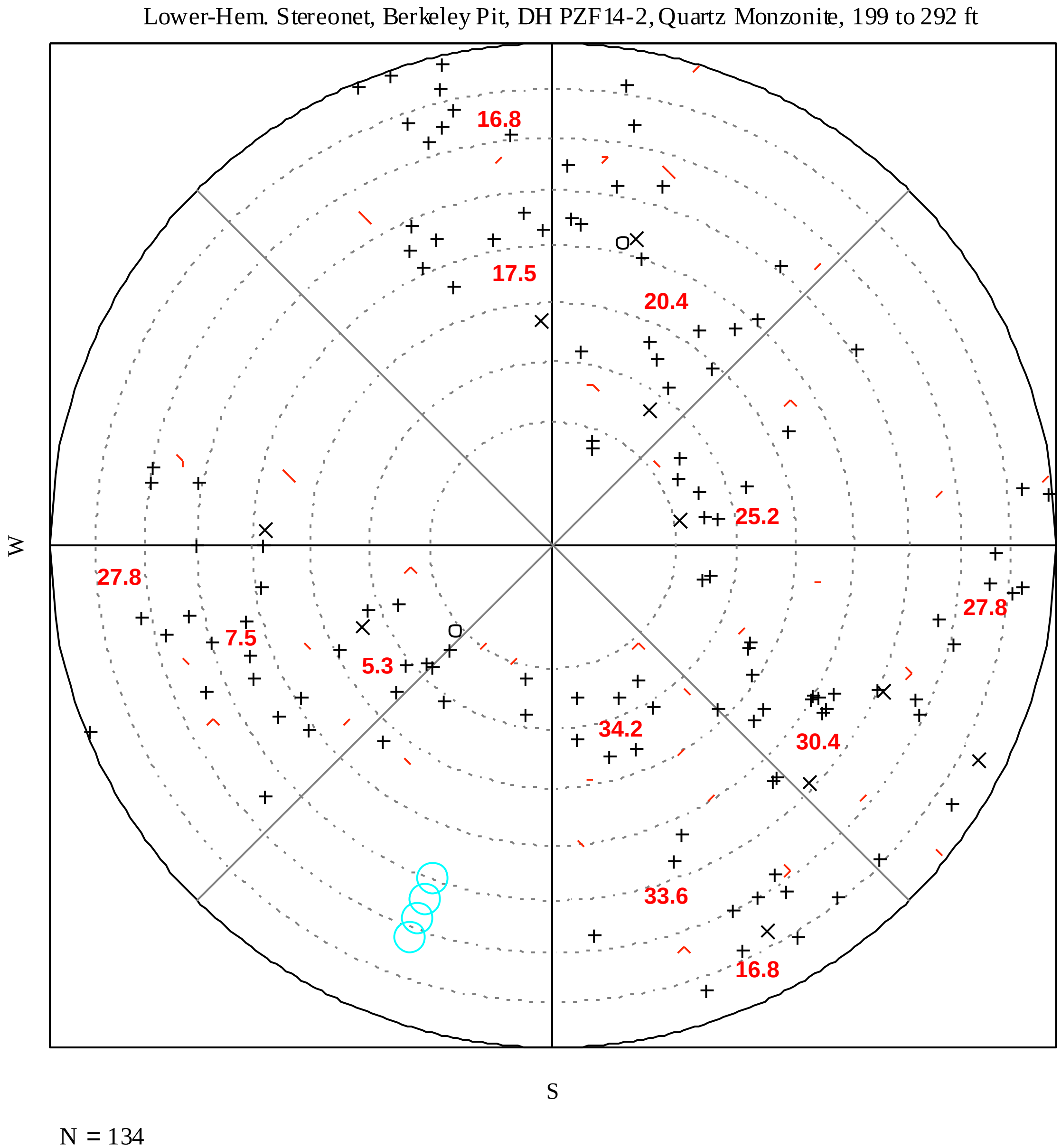

Figure A6. Quartz Monzonite, Rock Discontinuity Sets: DH PZF14-2, 199 to 292 ft.

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Integrity from the Ground Up

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Rock Type	Depth (ft)	Struct.	Code	DDR	Dip	Roughness	Filling	Thickness (mm)	A.S. (ft)	Spc (ft)	Comments	Spacing Correction; "SMV" is set mean vector					
LC	169.80	JT	1	47	40	2	N		9.50	5.96	Set 4.3 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.62688**
LC	179.30	JT	1	45	26	0	CY		0.55	0.34			SMV	-0.37889	-0.32781	0.86544	
LC	179.85	JT	1	29	41	2	CY		0.95	0.60							
LC	180.80	JT	1	17	22	1	CY		8.70	5.45							
LC	189.50	JT	1	66	26	2	N										
		5				1.40				3.09	Mean Values, Set 4.3						
LC	160.90	JT	1	62	65	2	N		7.80	0.84	Set 7.6 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.10805**
LC	168.70	JT	1	39	58	3	N		0.70	0.08	Intermittent gray & red-brown weath. QMz		SMV	-0.37255	-0.78769	0.49066	
LC	169.40	JT	1	73	52	3	N		10.05	1.09							
LC	179.45	JT	1	90	52	2	CY		4.35	0.47							
LC	183.80	JT	1	88	66	3	N		3.70	0.40							
LC	187.50	JT	1	74	65	1	CY		2.85	0.31							
LC	190.35	JT	1	52	55	2	N		7.05	0.76							
LC	197.40	FT	2	79	56	0	N				Slickensides						
		8				2.00				0.56	Mean Values, Set 7.6						
LC	169.60	JT	1	198	33	2	N		0.40	0.17	Set 19.3 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.41934**
LC	170.00	JT	1	193	40	3	N		3.80	1.59			SMV	0.54929	0.08995	0.83078	
LC	173.80	FT	2	180	24	0	CY		25.35	10.63	Slickensides						
LC	199.15	JT	1	184	39	2	N										
		4				1.75				4.13	Mean Values, Set 19.3						
LC	165.70	JT	1	250	42	3	N		0.50	0.30	Set 22.4 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.60770**
LC	166.20	JT	1	214	37	2	CY		3.75	2.28			SMV	0.45353	0.51482	0.72751	
LC	169.95	JT	1	232	50	3	N		0.65	0.40							
LC	170.60	JT	1	231	60	2	N		5.70	3.46							
LC	176.30	JT	1	220	41	1	N		15.55	9.45							
LC	191.85	JT	1	231	43	2	N		6.15	3.74							
LC	198.00	JT	1	218	34	2	N										
		7				2.14				3.27	Mean Values, Set 22.4						
LC	165.60	FT	2	317	58	0	N		3.20	3.20	Set 31.4 Leach Cap; Slickensides	129.5	47.2	-0.43218	0.52427	0.73373	**0.99957**
LC	168.80	JT	1	288	30	2	N		4.15	4.15			SMV	-0.45764	0.51130	0.72742	
LC	172.95	JT	1	312	40	2	N		2.70	2.70							
LC	175.65	JT	1	328	38	2	N		0.75	0.75							
LC	176.40	FT	2	321	63	0	N		0.40	0.40	Slickensides						
LC	176.80	FT	2	306	37	0	N		4.20	4.20	Slickensides						
LC	181.00	JT	1	292	47	2	CY		2.35	2.35							
LC	183.35	JT	1	340	44	2	N		0.60	0.60							
LC	183.95	JT	1	314	45	2	N		0.70	0.70							
LC	184.65	FT	2	306	42	0	CY		0.25	0.25	Slickensides						

LC	184.90	FT	2	312	42	1	CY		6.10	6.10	Slickensides						
LC	191.00	JT	1	312	44	2	N		0.80	0.80							
LC	191.80	JT	1	307	42	2	N		1.60	1.60							
LC	193.40	JT	1	304	36	2	N		0.45	0.45							
LC	193.85	JT	1	320	34	1	N										
		15				1.33				2.02	Mean Values, Set 31.4						
LC	160.95	JT	1	291	67	2	N		2.85	1.42	Set 8.8 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.49942**
LC	163.80	JT	1	265	85	2	N		1.70	0.85			SMV	-0.01222	-0.99958	0.02638	
LC	165.50	JT	1	302	78	2	N		5.40	2.70							
LC	170.90	JT	1	97	86	2	N		4.70	2.35							
LC	175.60	JT	1	274	90	2	N		4.80	2.40							
LC	180.40	JT	1	60	88	2	N		2.00	1.00							
LC	182.40	FT	2	95	72	0	N		7.75	3.87	Slickensides						
LC	190.15	FT	2	72	78	0	N		2.15	1.07	Slickensides						
LC	192.30	JT	1	248	85	2	N		2.90	1.45							
LC	195.20	JT	1	81	89	2	N		2.90	1.45							
LC	198.10	JT	1	108	86	3	N		0.10	0.05							
LC	198.20	JT	1	281	87	3	N										
		12				1.83				1.69	Mean Values, Set 8.8						
LC	162.00	JT	1	153	82	2	N		8.65	4.42	Set 16.8 Leach Cap	129.5	47.2	-0.43218	0.52427	0.73373	**0.51073**
LC	170.65	JT	1	150	68	2	N		1.95	1.00			SMV	0.93584	-0.33875	0.09720	
LC	172.60	FT	2	319	81	0	N		7.10	3.63	Slickensides						
LC	179.70	JT	1	173	79	2	N		1.60	0.82							
LC	181.30	JT	1	186	88	2	CY		4.50	2.30							
LC	185.80	JT	1	156	79	2	CY		2.40	1.23							
LC	188.20	FT	2	326	81	0	N		1.70	0.87	Slickensides						
LC	189.90	JT	1	320	81	1	CY		3.60	1.84							
LC	193.50	JT	1	159	90	2	N		2.10	1.07							
LC	195.60	JT	1	175	72	3	N		0.40	0.20							
LC	196.00	JT	1	183	76	3	N										
		11				1.73				1.74	Mean Values, Set 16.8						

Rock Type	Depth (ft)	Struct.	Code	DDR	Dip	Roughness	Filling	Thickness (mm)	A.S. (ft)	Spc (ft)	Comments	Spacing Correction; "SMV" is set mean vector					
QMz	203.20	CT	3	49	21	2	N		5.60	3.10	Set 5.3 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.55293**
QMz	208.80	FT	2	67	34	0	CY		24.70	13.66	Slickensides		SMV	-0.30799	-0.40443	0.86115	
QMz	233.50	JT	1	45	28	2	CY		8.10	4.48							
QMz	241.60	JT	1	47	35	2	N		19.50	10.78							
QMz	261.10	JT	1	71	32	1	CY	1	2.60	1.44							
QMz	263.70	JT	1	69	27	1	CY	3	0.75	0.41							
QMz	264.45	JT	1	51	31	2	CY	2	12.25	6.77							
QMz	276.70	JT	1	35	31	2	N		2.80	1.55							
QMz	279.50	JT	1	47	28	1	CY	1	0.60	0.33							
QMz	280.10	JT	1	41	43	2	N		1.85	1.02							
QMz	281.95	JT	1	64	39	2	N		6.05	3.35							
QMz	288.00	JT	1	45	24	2	CY	2									
		12				1.58				4.26	Mean Values, Set 5.3						
QMz	199.30	JT	1	82	49	1	N		1.10	0.12	Set 7.5 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.11326**
QMz	200.40	JT	1	70	54	3	N		10.50	1.19	Gray quartz monzonite at 199.3 ft		SMV	-0.23020	-0.78281	0.57811	
QMz	210.90	JT	1	79	63	2	CY		6.10	0.69							
QMz	217.00	JT	1	90	48	2	N		3.50	0.40							
QMz	220.50	JT	1	53	51	2	N		28.80	3.26							
QMz	249.30	JT	1	49	65	2	N		4.00	0.45							
QMz	253.30	JT	1	67	64	1	N		4.10	0.46							
QMz	257.40	JT	1	100	61	3	N		13.60	1.54							
QMz	271.00	JT	1	58	54	2	N		0.75	0.08	Harder QMz with cleaner fracs						
QMz	271.75	JT	1	74	60	2	N		1.45	0.16							
QMz	273.20	JT	1	59	49	2	N		1.60	0.18							
QMz	274.80	JT	1	66	55	2	N		4.05	0.46							
QMz	278.85	JT	1	90	60	1	N		1.35	0.15							
QMz	280.20	FT	2	93	48	0	CY	30	4.30	0.49	Slickensides; fault thickness 1.2 in.						
QMz	284.50	JT	1	76	53	2	CY										
		15				1.80				0.69	Mean Values, Set 7.5						
QMz	217.20	JT	1	185	54	2	N		11.70	0.37	Set 17.5 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.03125**
QMz	228.90	FT	2	177	37	1	CY		6.60	0.21	228.6-229.5ft fault zone		SMV	0.78087	-0.14656	0.60726	
QMz	235.50	JT	1	156	59	2	N		14.40	0.45							
QMz	249.90	JT	1	182	65	2	N		7.90	0.25							
QMz	257.80	JT	1	159	46	2	N		4.10	0.13							
QMz	261.90	JT	1	154	55	2	N		3.30	0.10							
QMz	265.20	JT	1	159	55	2	N		12.55	0.39							
QMz	277.75	JT	1	178	53	2	N		0.45	0.01							
QMz	278.20	JT	1	175	56	1	CY/PY	10	0.50	0.02	Clay & pyrite filling						
QMz	278.70	JT	1	169	52	2	PY		1.20	0.04							
QMz	279.90	JT	1	155	51	1	N		6.90	0.22							

QMz	286.80	JT	1	183	55	2	N										
		12				1.75				0.20	Mean Values, Set 17.5						
QMz	201.95	JT	1	216	32	1	N		1.85	0.76	Set 20.4 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.40840**
QMz	203.80	CT	3	193	52	0	CY	2	1.45	0.59	Slickensides		SMV	0.63445	0.31262	0.70693	
QMz	205.25	JT	1	222	39	2	CY		3.75	1.53							
QMz	209.00	JT	1	220	47	2	N		0.40	0.16							
QMz	209.40	JT	1	209	35	2	CY		2.80	1.14	209.6-210.0ft dark grn to black zone						
QMz	212.20	JT	1	219	61	2	CY		20.30	8.29							
QMz	232.50	JT	1	222	51	2	N		0.70	0.29							
QMz	233.20	FT	2	195	53	0	CY		11.60	4.74	Slickensides						
QMz	244.80	JT	1	214	43	2	N		3.55	1.45							
QMz	248.35	JT	1	197	50	2	N		5.25	2.14							
QMz	253.60	JT	1	197	64	2	N		17.80	7.27							
QMz	271.40	JT	1	205	37	2	N		4.40	1.80							
QMz	275.80	JT	1	188	32	2	N		7.60	3.10							
QMz	283.40	JT	1	190	62	3	CY		5.00	2.04							
QMz	288.40	FT	2	215	27	0	CY	5			Slickensides						
		15				1.60				2.95	Mean Values, Set 20.4						
QMz	209.00	209.00	1	242	23	2	CY		14.00	11.72	Set 25.2 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.83682**
QMz	223.00	223.00	1	235	25	2	CL		2.65	2.22	Lacks biotite in fabric		SMV	0.10831	0.43318	0.89477	
QMz	225.65	225.65	1	244	43	2	N		14.55	12.18							
QMz	240.20	240.20	2	259	21	0	CY	2	26.05	21.80	Slickensides						
QMz	266.25	266.25	1	253	33	2	N		7.15	5.98							
QMz	273.40	273.40	1	281	26	2	N		0.55	0.46							
QMz	273.95	273.95	1	250	25	1	CY		3.35	2.80							
QMz	277.30	277.30	1	259	25	2	N		2.00	1.67							
QMz	279.30	279.30	1	261	27	1	N		8.10	6.78							
QMz	287.40	287.40	1	283	25	3	N										
		10				1.70				7.29	Mean Values, Set 25.2						
QMz	204.70	JT	1	301	53	2	N		6.90	6.84	Set 30.4 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.99195**
QMz	211.60	JT	1	311	44	2	N		8.35	8.28			SMV	-0.42010	0.62522	0.65774	
QMz	219.95	JT	1	301	50	2	N		13.75	13.64							
QMz	233.70	JT	1	294	60	2	N		4.90	4.86							
QMz	238.60	JT	1	316	54	2	N		4.60	4.56							
QMz	243.20	JT	1	303	39	3	N		0.45	0.45							
QMz	243.65	JT	1	302	53	2	N		1.65	1.64							
QMz	245.30	FT	2	313	59	0	CY		4.80	4.76	Slickensides						
QMz	250.10	JT	1	300	50	2	N		4.15	4.12							
QMz	254.25	JT	1	298	53	2	N		3.65	3.62							
QMz	257.90	JT	1	317	54	2	N		4.95	4.91							
QMz	262.85	JT	1	298	36	2	N		0.05	0.05							

QMz	262.90	JT	1	296	36	2	N		8.20	8.13							
QMz	271.10	JT	1	308	44	1	N		2.70	2.68							
QMz	273.80	JT	1	315	38	2	N		9.65	9.57							
QMz	283.45	JT	1	300	51	2	N		8.75	8.68							
QMz	292.20	FT	2	294	61	1	CY/PY	38			Slickensides						
		17				1.82				5.42	Mean Values, Set 30.4						
QMz	222.50	JT	1	353	32	2	N		7.00	6.34	Set 34.2 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.90568**
QMz	229.50	JT	1	9	28	1	CY		8.90	8.06	Begin QM enrichment zone at 223ft		SMV	-0.46188	0.11616	0.87930	
QMz	238.40	JT	1	328	26	1	CY		0.40	0.36							
QMz	238.80	JT	1	351	25	1	CY	2	3.45	3.12							
QMz	242.25	JT	1	338	36	3	N		3.55	3.22							
QMz	245.80	JT	1	345	36	1	N		7.55	6.84							
QMz	253.35	JT	1	12	22	2	N		4.00	3.62							
QMz	257.35	JT	1	337	27	1	N		16.30	14.76							
QMz	273.65	JT	1	328	31	1	CY	1									
		9				1.44				5.79	Mean Values, Set 34.2						
QMz	235.10	JT	1	336	53	1	N		18.80	16.30	Set 33.6 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.86698**
QMz	253.90	JT	1	330	70	2	N		10.30	8.93			SMV	-0.82287	0.35963	0.43996	
QMz	264.20	JT	1	354	67	1	N		18.25	15.82							
QMz	282.45	JT	1	334	70	2	N		7.45	6.46							
QMz	289.90	JT	1	339	57	1	CY		1.90	1.65							
QMz	291.80	JT	1	326	68	2	N										
		6				1.50				9.16	Mean Values, Set 33.6						
QMz	201.10	JT	1	157	89	1	CY	3	16.45	9.19	Set 16.8 Quartz Monzonite	129.5	47.2	-0.43218	0.52427	0.73373	**0.55852**
QMz	217.55	JT	1	161	78	2	N		9.05	5.05	218.6-219.5ft rubble zone		SMV	0.94438	-0.32757	0.02910	
QMz	226.60	JT	1	174	71	2	CY		7.85	4.38	227.3-228.1ft Silica-rich/quartz (vein?)						
QMz	234.45	JT	1	335	78	2	N		4.80	2.68							
QMz	239.25	JT	1	328	81	2	CY		0.35	0.20							
QMz	239.60	FT	2	331	77	0	CY		1.70	0.95	Slickensides						
QMz	241.30	JT	1	326	72	2	N		3.30	1.84	Gray QMz with biotite						
QMz	244.60	JT	1	314	79	1	CY		3.50	1.95							
QMz	248.10	JT	1	167	78	1	CY	2	3.25	1.82							
QMz	251.35	JT	1	191	74	3	N		6.60	3.69							
QMz	257.95	JT	1	167	88	2	N		9.85	5.50							
QMz	267.80	JT	1	165	75	1	CY		0.70	0.39							
QMz	268.50	JT	1	189	82	2	N		0.90	0.50							
QMz	269.40	JT	1	163	73	1	CY		4.10	2.29							
QMz	273.50	JT	1	341	83	1	N		11.65	6.51							
QMz	285.15	JT	1	161	89	2	N		0.45	0.25							
QMz	285.60	JT	1	321	79	3	N		0.25	0.14							
QMz	285.85	JT	1	166	83	2	CY/PY										
		18				1.67				2.78	Mean Values, Set 16.8						

QMz	203.95	JT	1	263	83	2	N		3.05	1.90	Set 27.8 Quartz Monzonite
QMz	207.00	JT	1	295	69	2	N		4.90	3.05	
QMz	211.90	JT	1	264	89	1	N		13.40	8.34	
QMz	225.30	JT	1	101	70	2	CL		11.20	6.97	223.5-224.6ft dark gry to black zone
QMz	236.50	JT	1	293	67	1	CY		5.35	3.33	Calcite crystals 2-5mm on surface
QMz	241.85	JT	1	303	84	1	CY	1	8.75	5.45	
QMz	250.60	JT	1	68	89	2	N		9.30	5.79	
QMz	259.90	FT	2	297	84	0	CY	100	1.10	0.68	Slickensides
QMz	261.00	JT	1	275	76	2	N		3.60	2.24	
QMz	264.60	JT	1	271	77	3	N		2.20	1.37	
QMz	266.80	FT	2	80	72	0	CY	75	1.35	0.84	Slickensides
QMz	268.15	JT	1	276	81	2	CY		1.60	1.00	
QMz	269.75	JT	1	99	70	2	N		11.05	6.88	
QMz	280.80	JT	1	77	68	2	N		6.20	3.86	
QMz	287.00	JT	1	275	83	2	N		2.40	1.49	
QMz	289.40	JT	1	281	67	2	CY		1.40	0.87	QME (lacking biotite)
QMz	290.80	JT	1	284	71	2	N				
		17				1.65				3.38	Mean Values, Set 27.8

129.5	47.2	-0.43218	0.52427	0.73373	**0.62252**
	SMV	-0.11301	0.99084	0.07388	

ATTACHMENT 2

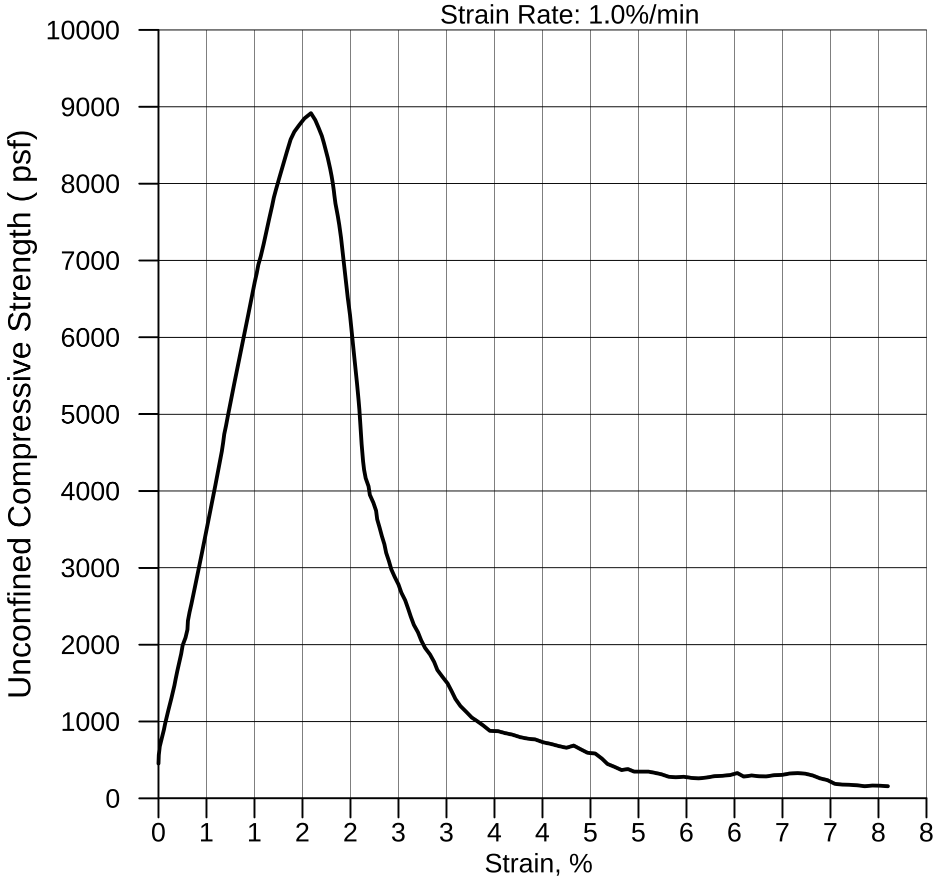
Oriented Core Hole PZF14-2:

Laboratory Testing: Unconfined Compression Test Results

Laboratory Testing: Direct Shear Test Results

UNCONFINED COMPRESSION
ASTM D 2166

Project: Berkely Pit Slope Stability
Client: Montana Resources, LLP
Project Number: MI14010C
Sample Identification: PZF14-2 @ 168 to 168.5 ft.
Sample Type: Rock core
Sample Classification: Altered Quartz Monzonite
Date Tested: 4/16/2014 By: DA
Sample Dry Unit Weight: 121.3 pcf
Moisture Content: 12.1%
Length to Diam.: 2.48:1



Diameter: 2.417" Height: 5.987" Area: 4.588 in²

Unconfined Compressive Strength = 8,782.2 psf (60.99 psi) @ 1.59% Strain

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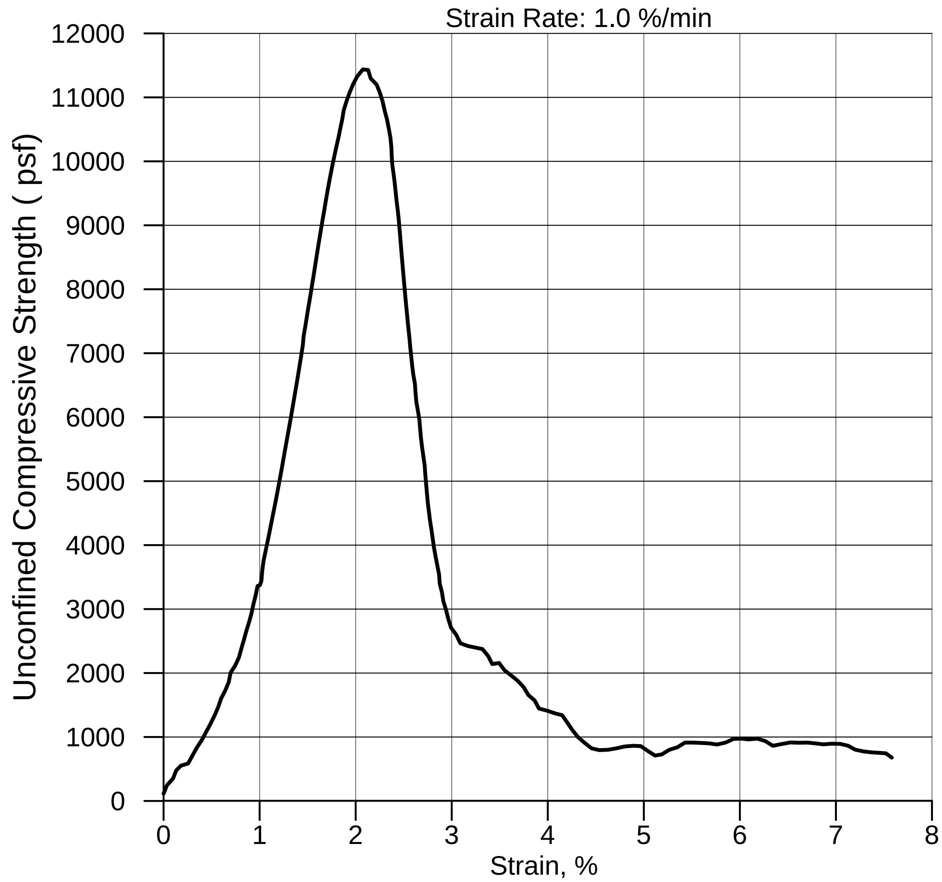
UNCONFINED COMPRESSION
ASTM D 2166

Project: Berkeley Pit Slope Stability
Client: Montana Resources, LLP
Project Number: MI14010C
Sample Identification: PZF14-2 @ 190.5 to 191.2 ft
Sample Type: Rock core
Sample Classification: Altered Quartz Monzonite
Date Tested: 4/16/2014 By: DA
Sample Dry Unit Weight: 125.7 pcf
Moisture Content: 10.5%
Length to Diam.: 2.42:1



Diameter: 2.413" Height: 5.832" Area: 4.573 in²

Unconfined Compressive Strength = 11,255.6 psf (78.16 psi) @ 2.12% Strain

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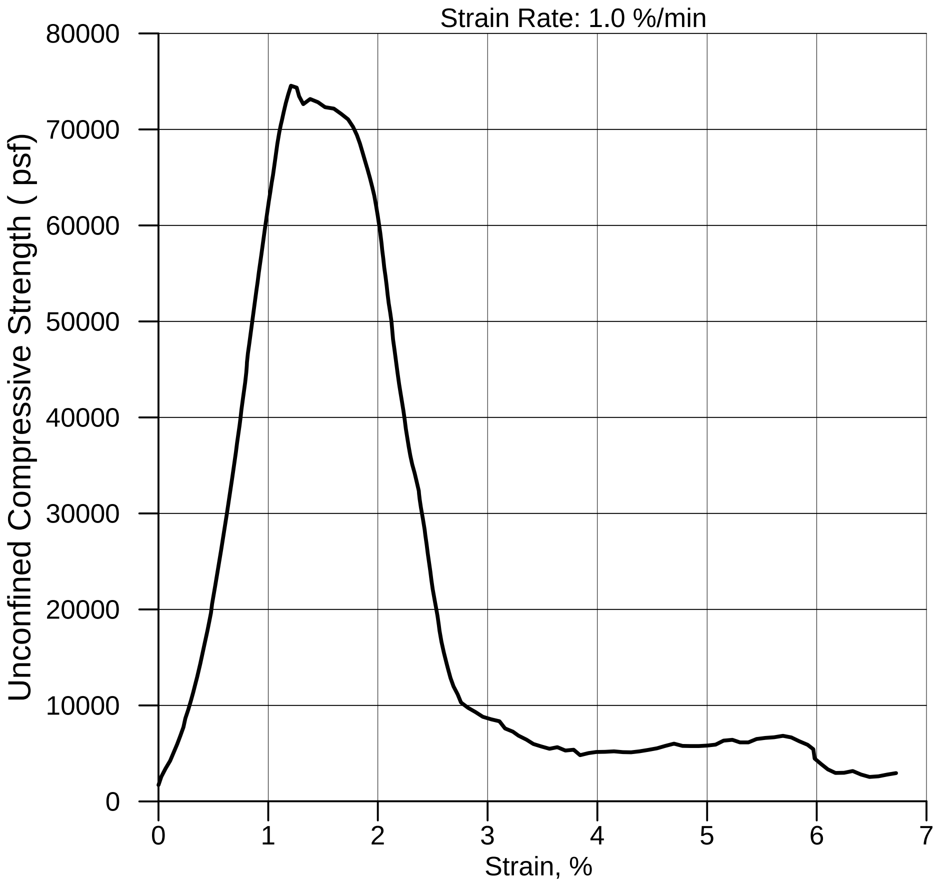
UNCONFINED COMPRESSION
ASTM D 2166

Project: Berkeley Pit Slope Stability
Client: Montana Resources, LLP
Project Number: MI14010C
Sample Identification: PZF14-2 @ 220.5 to 221.2 ft.
Sample Type: Rock core
Sample Classification: Altered Quartz Monzonite
Date Tested: 4/16/2014 By: DA
Sample Dry Unit Weight: 142.1 pcf
Moisture Content: 4.9%
Length to Diam.: 2.40:1



Diameter: 2.398" Height: 5.756" Area: 4.516 in²

Unconfined Compressive Strength = 73,938.6 psf (513.46 psi) @ 1.23% Strain

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

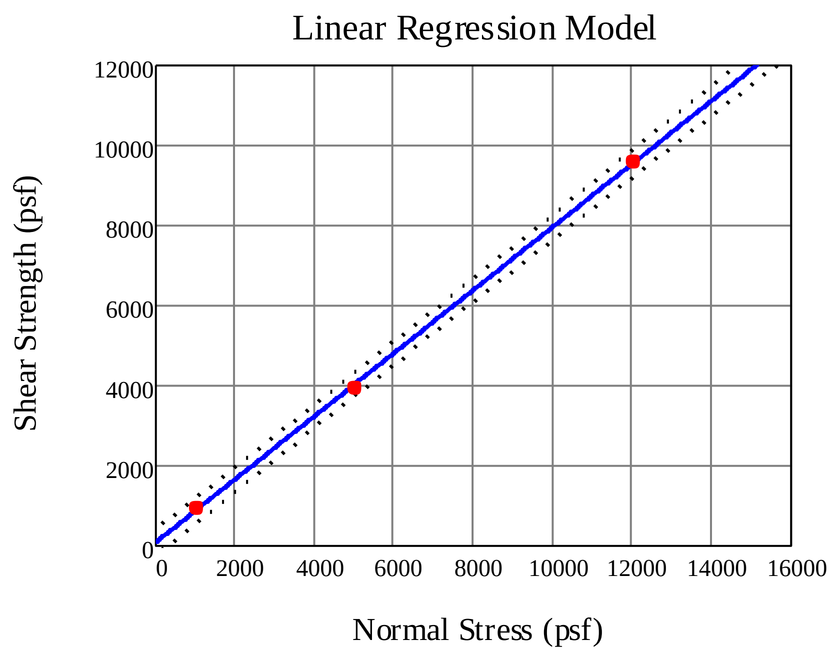
Sample ID: PFZ14-2 @ 132 ft
Fill: Red-Brown Clayey Sand
Residual Strength; Apr. 2014

$$D := \begin{pmatrix} 1000 & 950 \\ 5020 & 3940 \\ 12020 & 9600 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



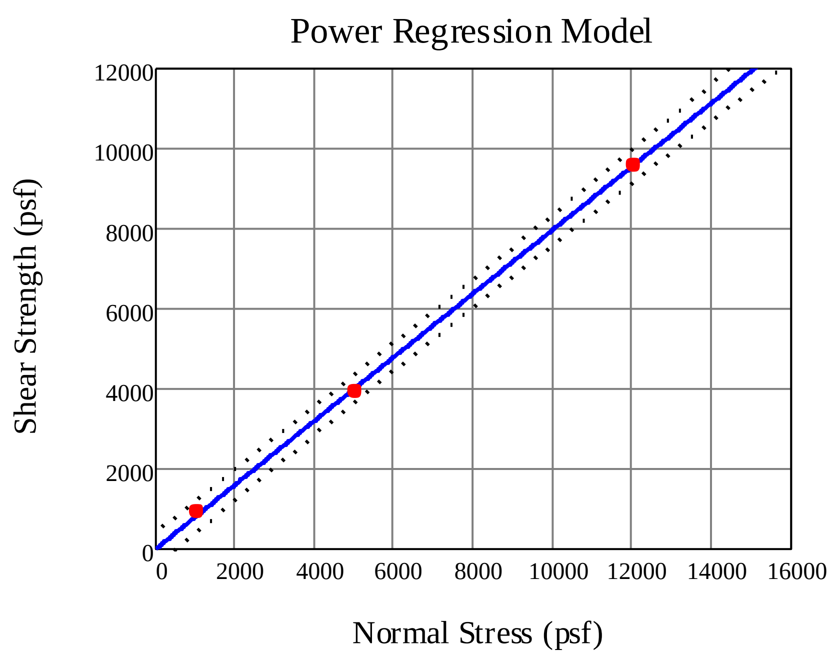
Linear Regression Coefs.: Y = C + MX

$C = 94.0$ $M = 0.78758$

$\phi = 38.2$

$S_e = 133.47$

$MD = 71.78$



Power Regression Coefs.: $Y = AX^B$

$A = 0.84261$ $B = 0.99405$

$s_e = 164.32$

$md = 81.42$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

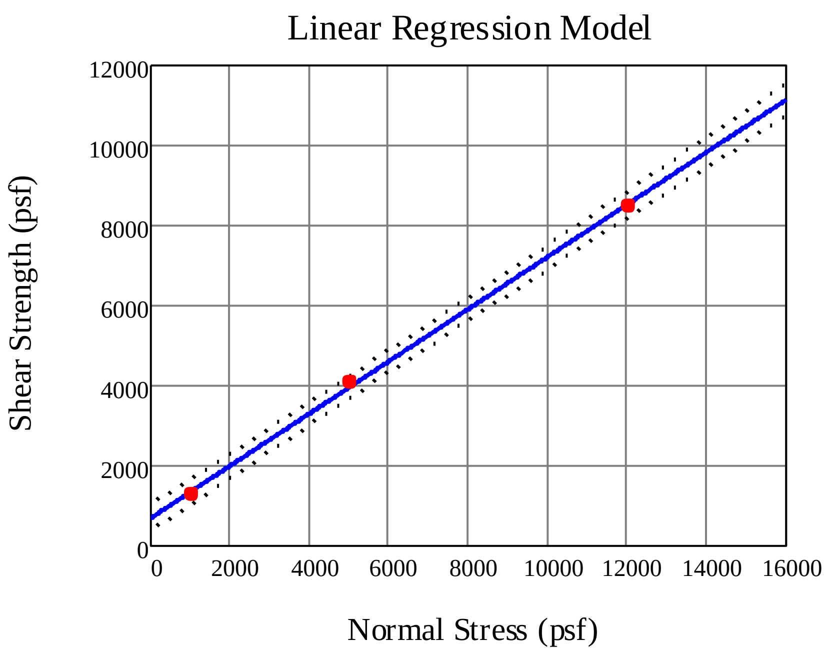
Sample ID: PFZ14-2 @ 150 ft
Fill: Red-Brown Clayey Sand
Residual Strength; Apr. 2014

$$D := \begin{pmatrix} 1000 & 1285 \\ 5020 & 4080 \\ 12020 & 8505 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



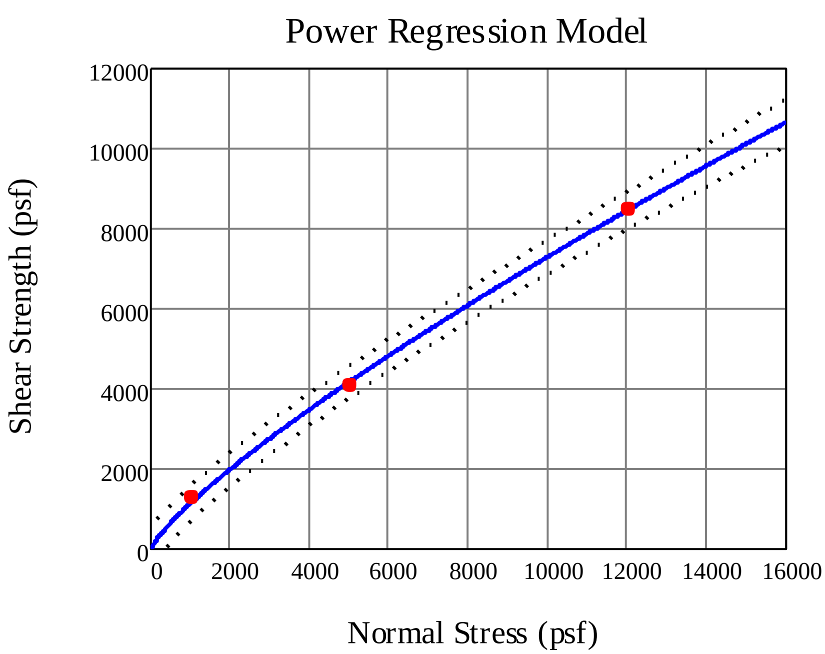
Linear Regression Coefs.: Y = C + MX

$C = 699.0$ $M = 0.65260$

$\phi = 33.1$

$S_e = 130.05$

$MD = 69.94$



Power Regression Coefs.: $Y = AX^B$

$A = 4.36942$ $B = 0.80576$

$s_e = 184.35$

$md = 96.47$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

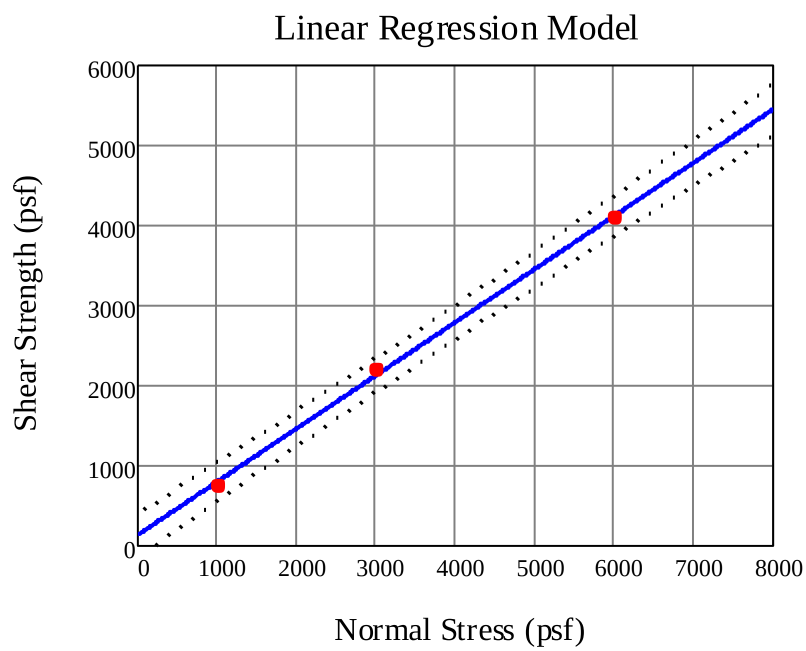
Sample ID: PZF12-7 @ 21 ft
Silty Sand (SM), Nonplastic
Residual Strength, Jan. 2013

$$D := \begin{pmatrix} 1000 & 754 \\ 3000 & 2211 \\ 6000 & 4091 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 8000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



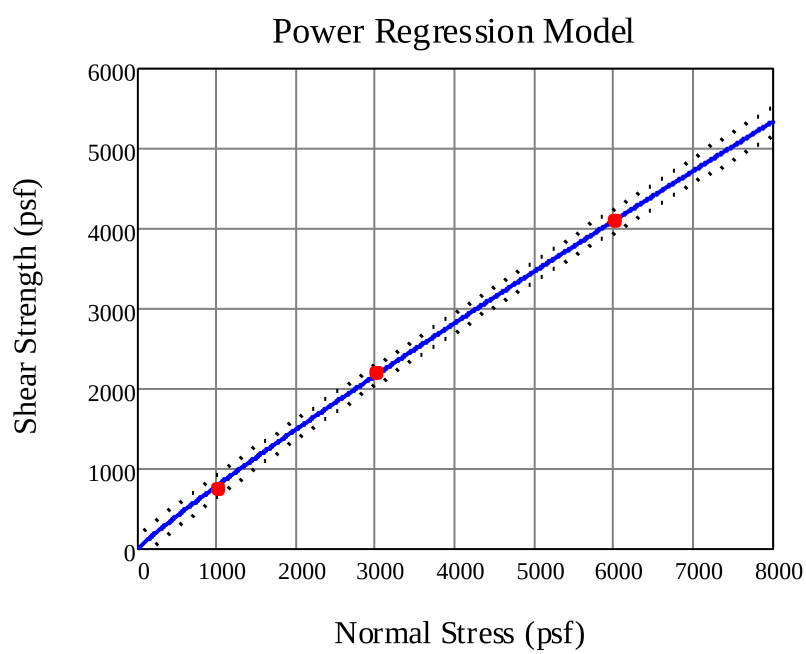
Linear Regression Coefs.: Y = C + MX

$C = 138.1$ $M = 0.66418$

$\phi = 33.6$

$S_e = 99.12$

$MD = 53.60$



Power Regression Coefs.: $Y = AX^B$

$A = 1.41039$ $B = 0.91679$

$s_e = 56.10$

$md = 29.87$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

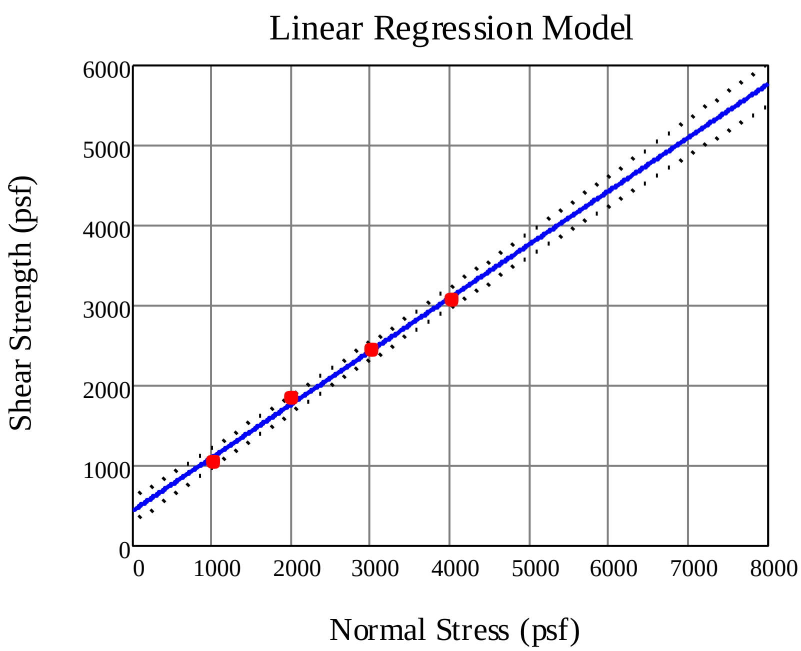
$$D := \begin{pmatrix} 1000 & 1050 \\ 2000 & 1850 \\ 3000 & 2450 \\ 4000 & 3070 \end{pmatrix}$$

Sample ID: Hoskins MRD Report, 1973
Sample No. 5
Clayey Sand (SC), LL=27, PI=10

$n := 4$

Maximum normal stress for plot: $Smax := 8000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



Linear Regression Coefs.: Y = C + MX

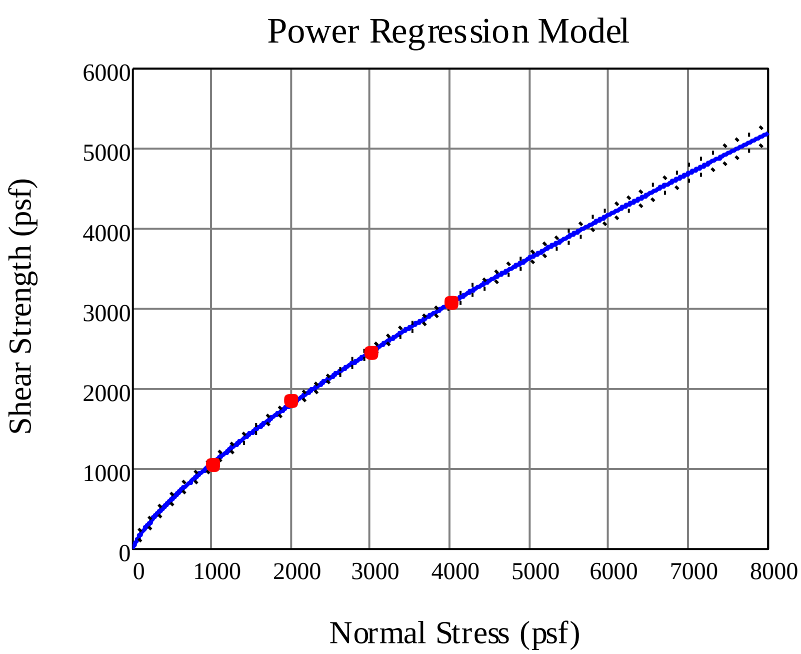
C = 440.0

M = 0.66600

ϕ = 33.7

S_e = 72.53

MD = 45.00



Power Regression Coefs.: Y = AX ^{B}

A = 5.67330

B = 0.7588

s_e = 32.31

md = 19.02

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Triaxial CD Shear Strength: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

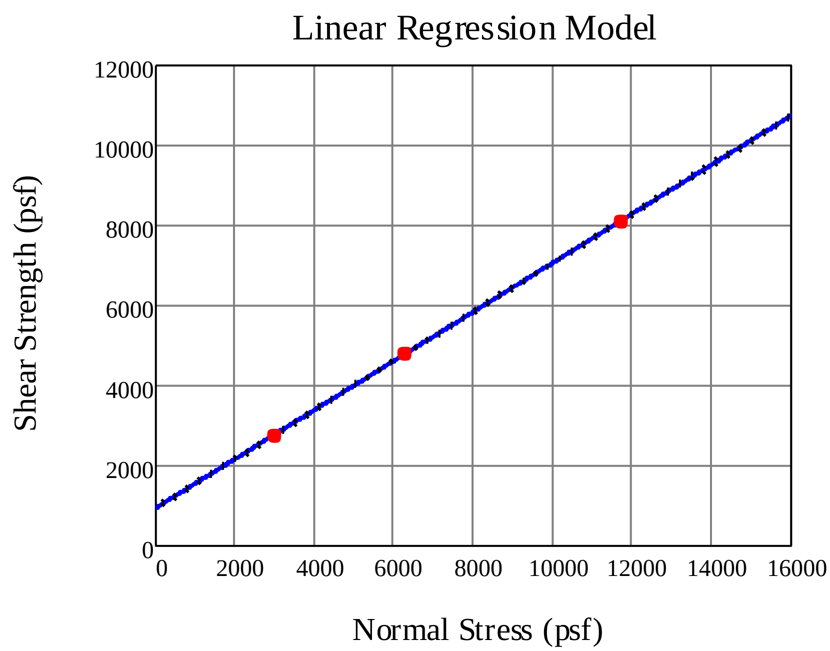
Sample ID: Golder Associates Report, 1980
DH 390B - 52 ft
Well-graded Sand with Silt (SW-SM)

$$D := \begin{pmatrix} 2970 & 2760 \\ 6260 & 4799 \\ 11691 & 8103 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



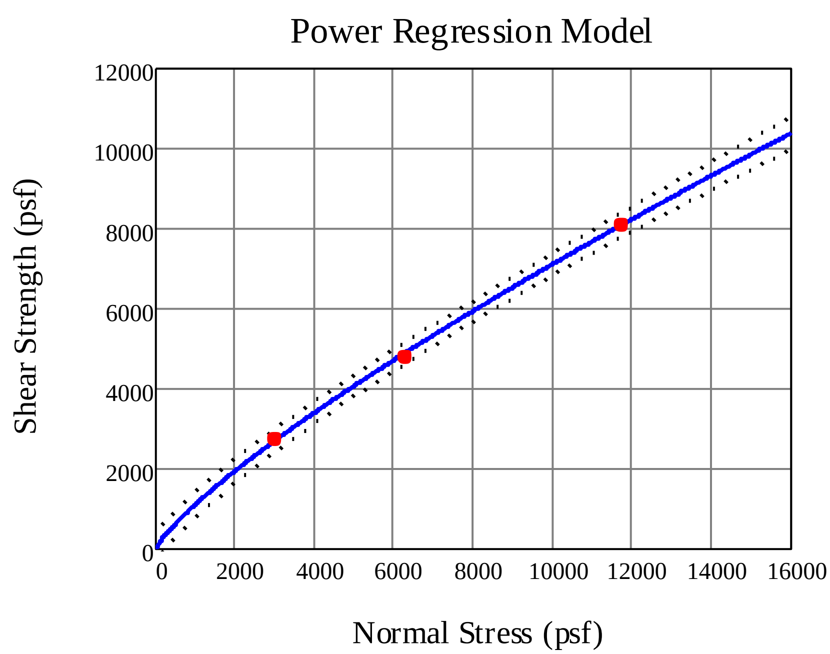
Linear Regression Coefs.: Y = C + MX

$C = 951.2$ $M = 0.61223$

$\phi = 31.5$

$S_e = 18.88$

$MD = 10.17$



Power Regression Coefs.: $Y = AX^B$

$A = 4.36214$ $B = 0.80322$

$s_e = 119.88$

$md = 64.37$

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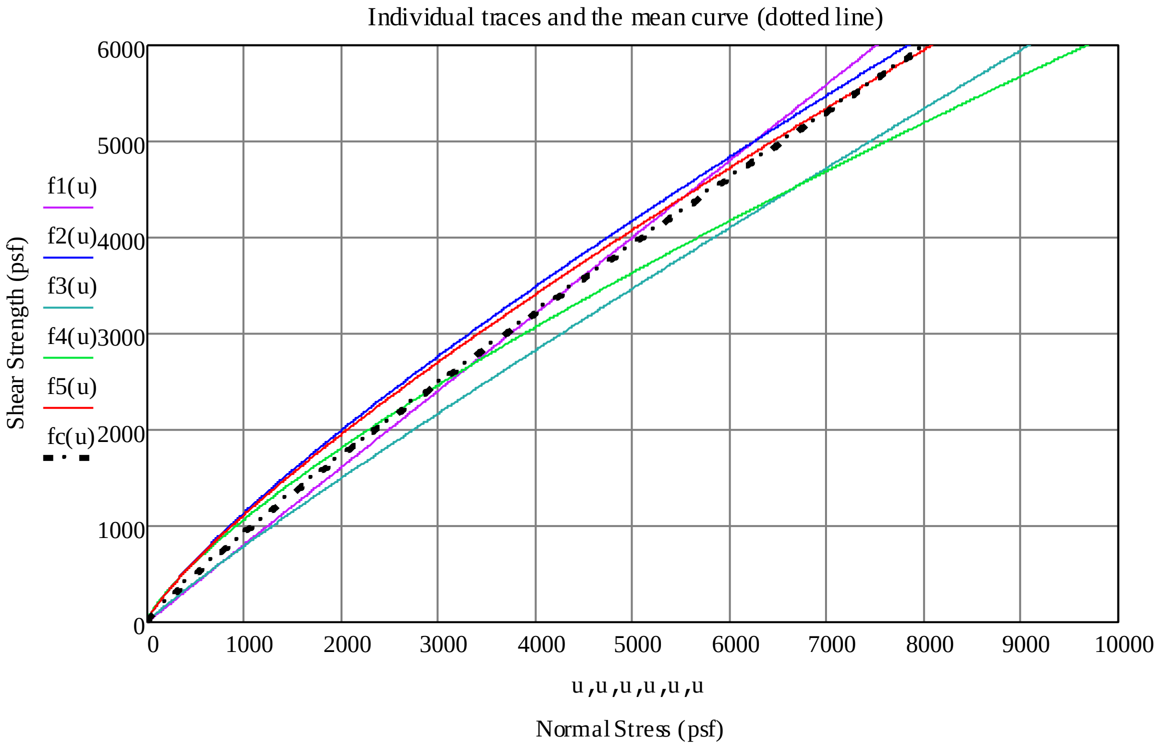
Shear-Strength Statistical Regression Combiner for the 5 Individual Tests; Clayey/Silty Sand Fill

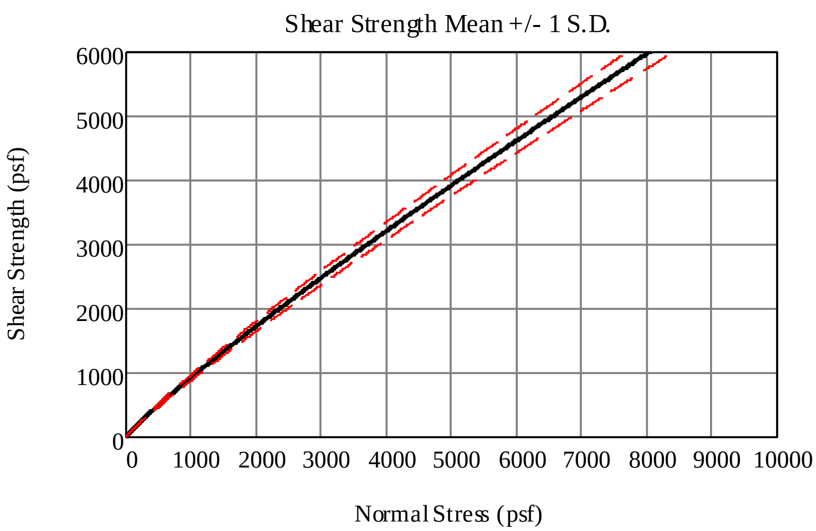


Mean Fit:

$Y = A\,X^{B}$ psf

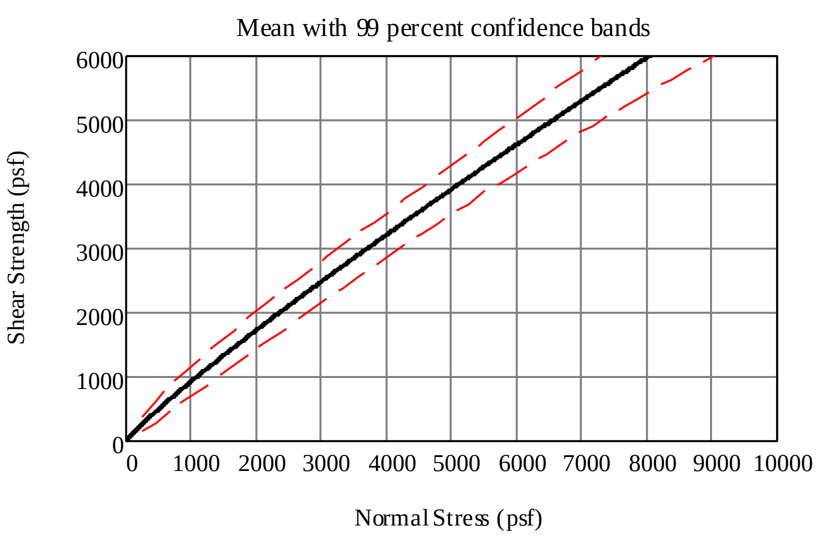
A = 1.9341

B = 0.8942



Ap = 2.0868 Bp = 0.8901

Am = 1.7855 Bm = 0.8986



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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

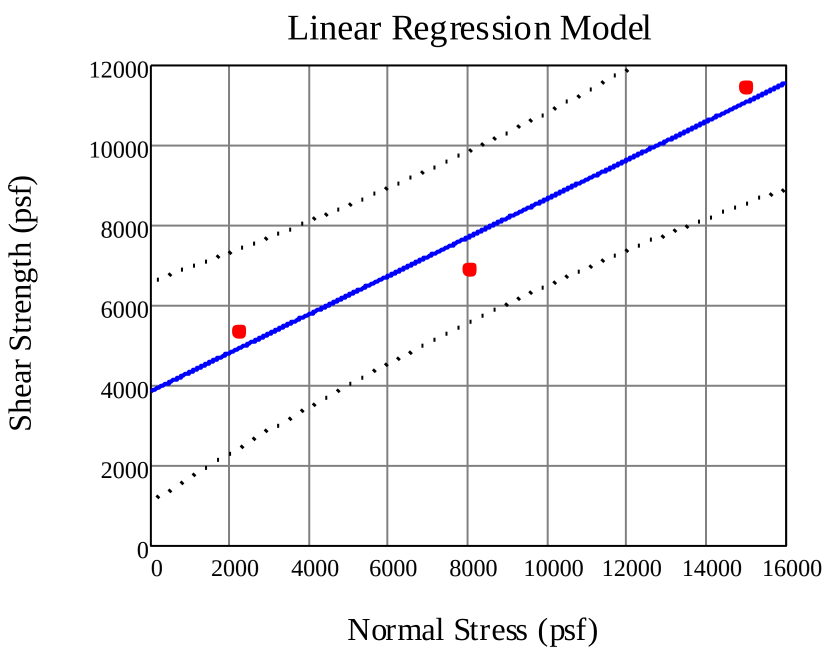
Sample ID: PFZ14-2 @ 172.5 ft
QM Leach Cap, Natural Fracture
Residual Strength; Apr. 2014

$$D := \begin{pmatrix} 2200 & 5375 \\ 8000 & 6896 \\ 15000 & 11459 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $S_{max} := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



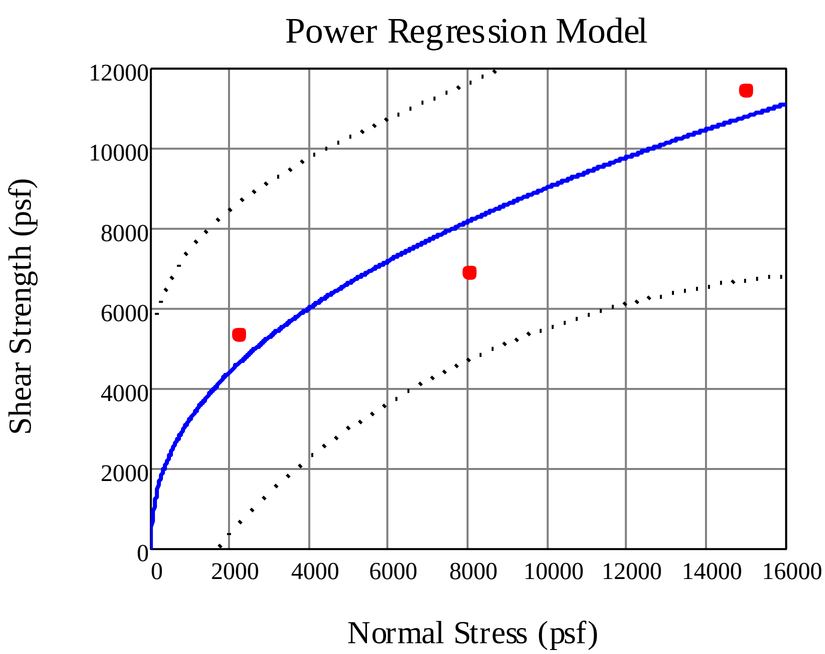
Linear Regression Coefs.: Y = C + MX

$C = 3866.8$ $M = 0.48133$

$\phi = 25.7$

$S_e = 1007.56$

$MD = 547.65$



Power Regression Coefs.: $Y = AX^{B}$

$A = 154.83898$ $B = 0.44147$

$s_e = 1627.35$

$md = 897.10$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

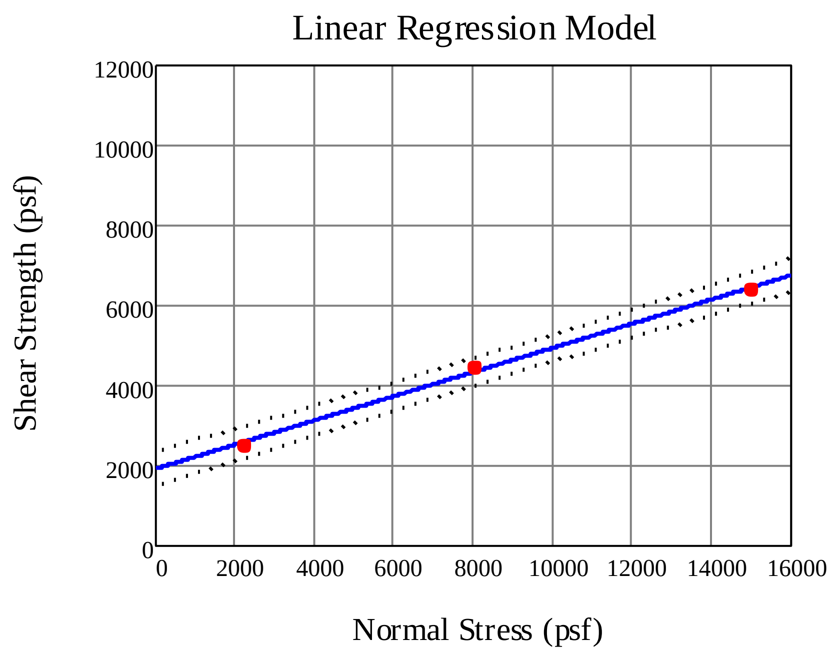
Sample ID: PFZ14-2 @ 182.0 ft
QM Leach Cap, Natural Fracture
Residual Strength; Apr. 2014

$$D := \begin{pmatrix} 2200 & 2523 \\ 8000 & 4475 \\ 15000 & 6399 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)



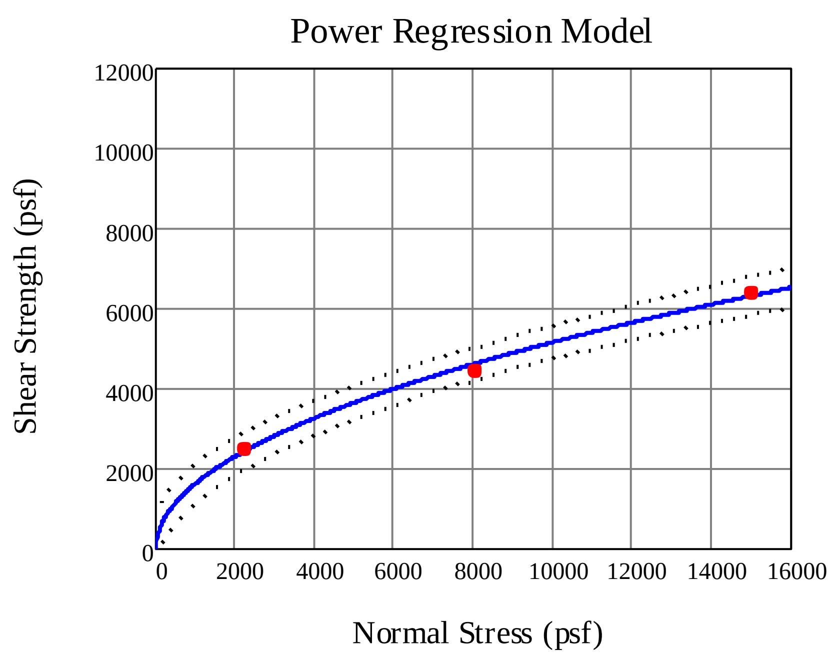
Linear Regression Coefs.: Y = C + MX

$C = 1930.0$ $M = 0.30186$

$\phi = 16.8$

$S_e = 159.54$

$MD = 86.72$



Power Regression Coefs.: $Y = AX^B$

$A = 52.45087$ $B = 0.4984$

$s_e = 190.54$

$md = 105.21$

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Direct-Shear Results: Linear Model and Nonlinear Power Model

X (normal stress) and Y (shear strength) data input to Array D:

Sample ID: PFZ14-2 @ 212 ft
Qtz Monzonite, Natural Fracture
Residual Strength; Apr. 2014

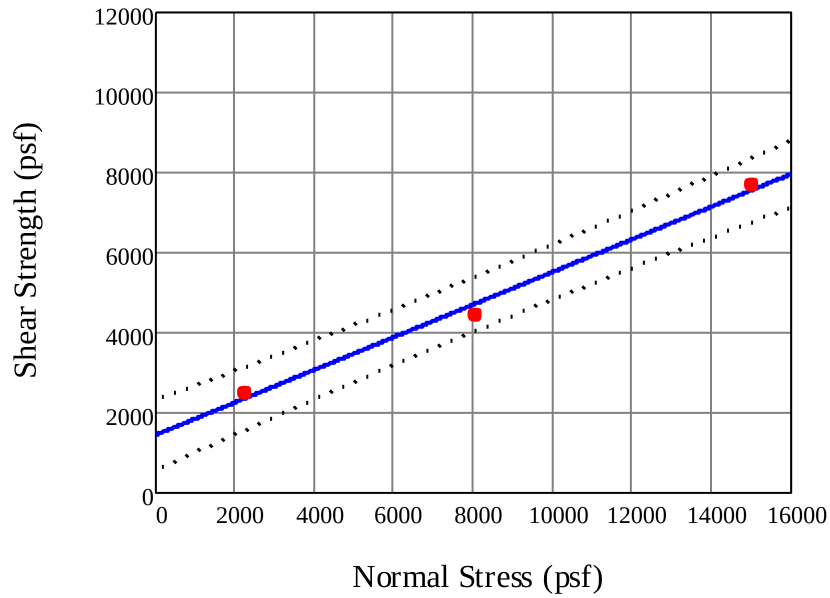
$$D := \begin{pmatrix} 2200 & 2488 \\ 8000 & 4447 \\ 15000 & 7677 \end{pmatrix}$$

$n := 3$

Maximum normal stress for plot: $Smax := 16000$

Significance level for regression error bands: $\alpha := 0.317$ (+/- 1 sd)

Linear Regression Model



Linear Regression Coefs.: Y = C + MX

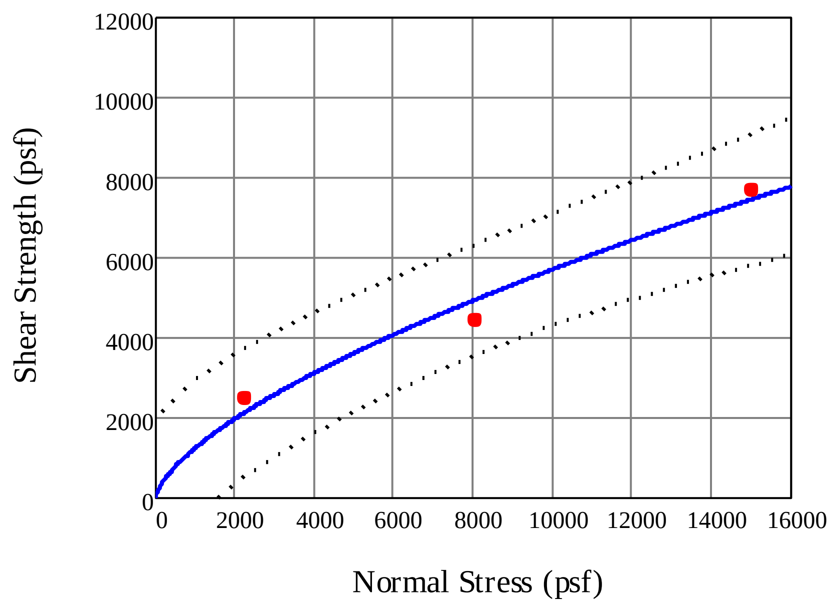
$C = 1449.3$ $M = 0.40730$

$\phi = 22.2$

$S_e = 319.82$

$MD = 173.83$

Power Regression Model



Power Regression Coefs.: $Y = AX^B$

$A = 13.47962$ $B = 0.65684$

$s_e = 653.01$

$md = 360.23$

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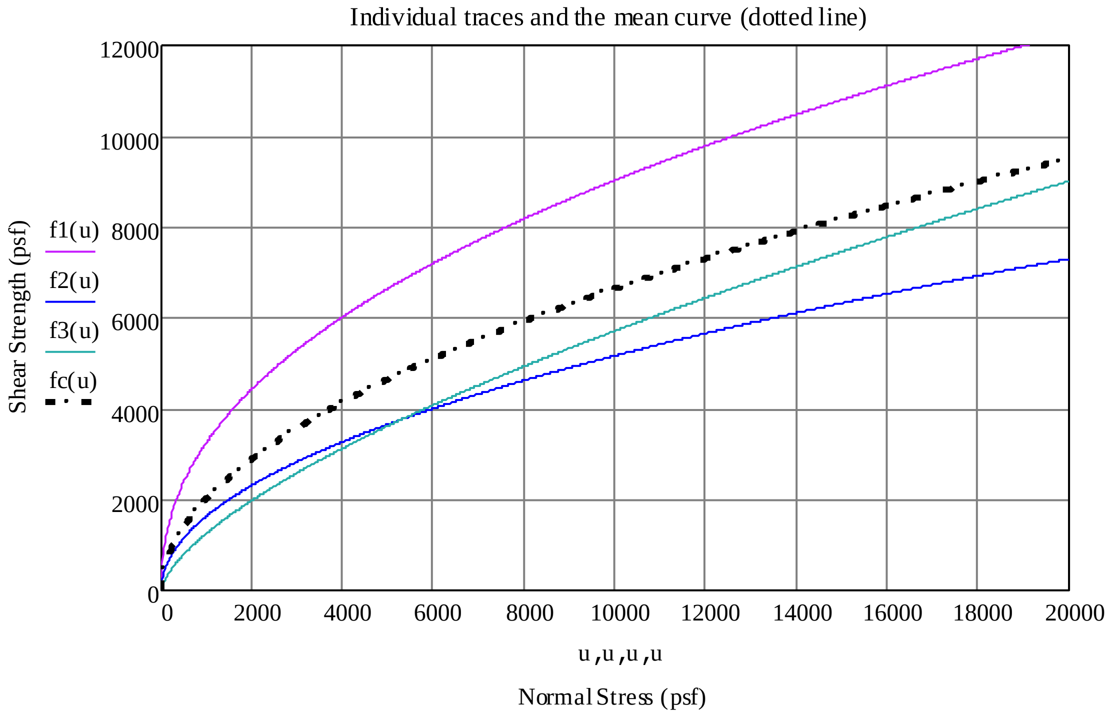
Shear-Strength Statistical Regression Combiner for the 3 Individual Tests; Qtz. Monzonite Natural Fractures

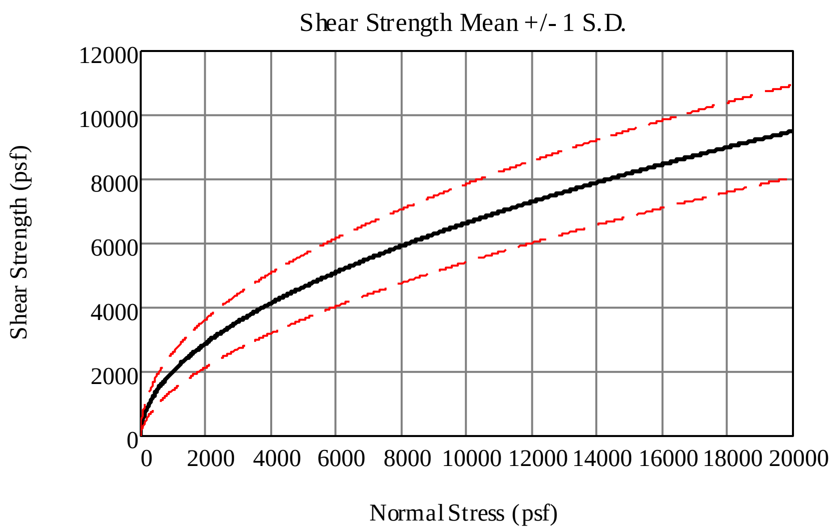


Mean Fit:

$Y = A\ X^{B}$ psf

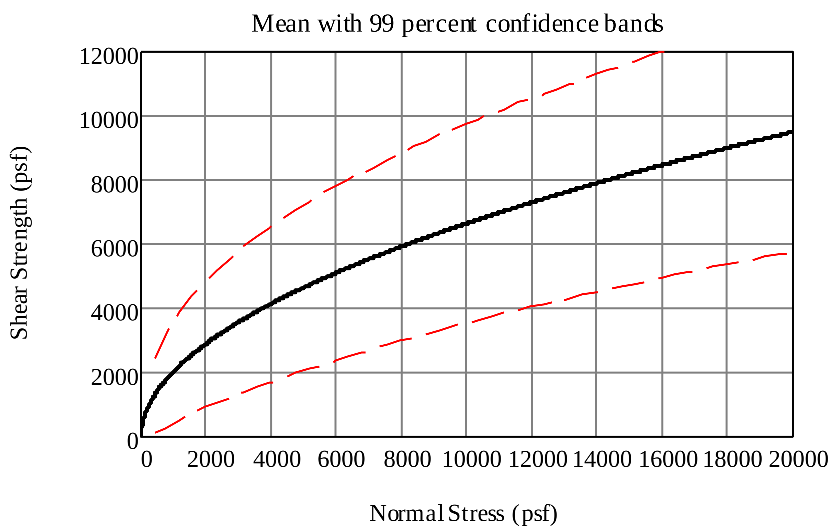
A = 57.6185

B = 0.5155



Ap = 98.0056 Bp = 0.4761

Am = 27.5093 Bm = 0.5737



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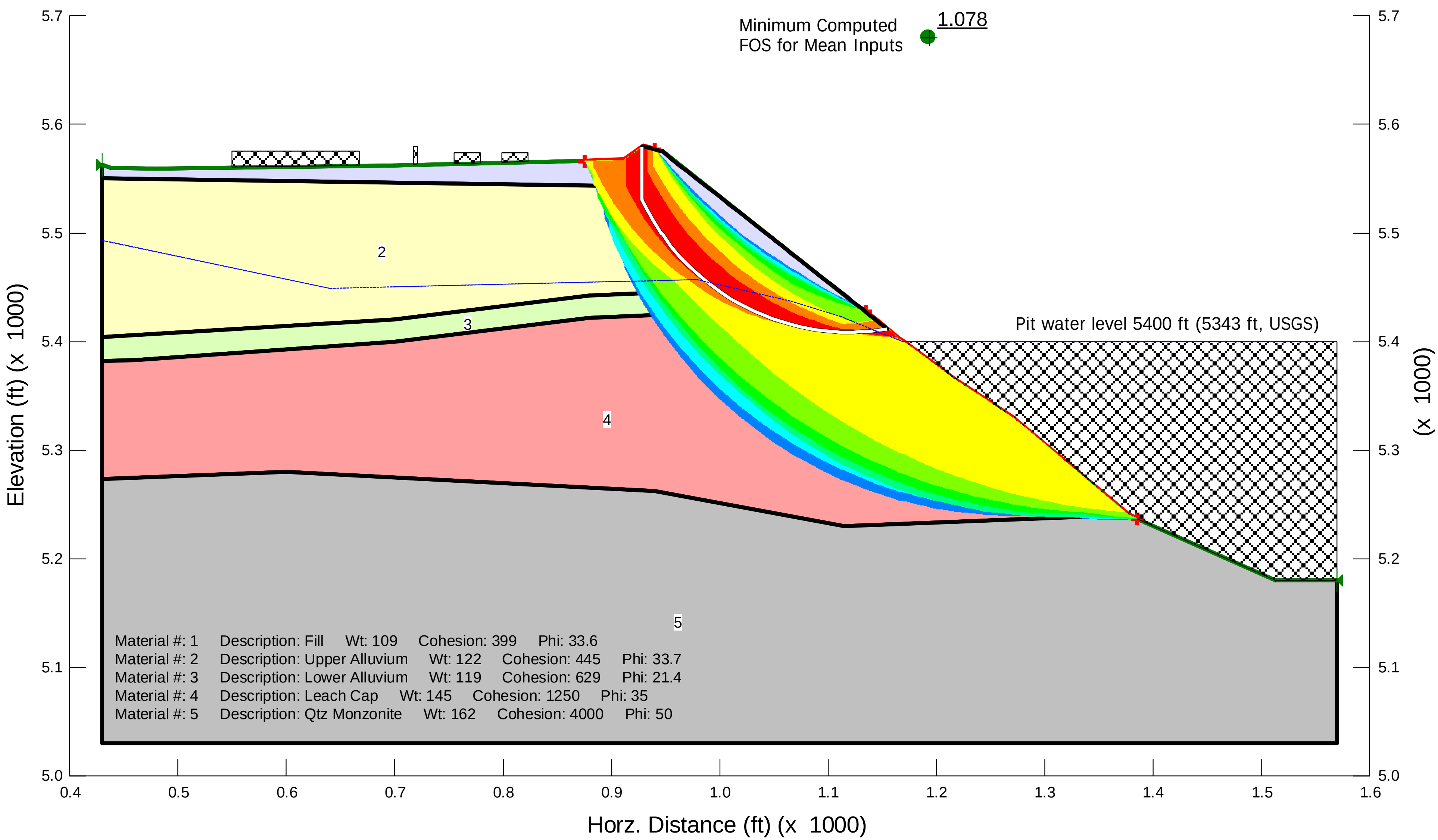
ATTACHMENT 3

Summary of Slope Stability Analysis Results

Concentrator Sector: Cross-Section 36300

Berkeley Pit: Original Stability Analysis of Cross-Section 36300, Potential Rotational Failures, Pit Water Level 5400 ft



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.03.

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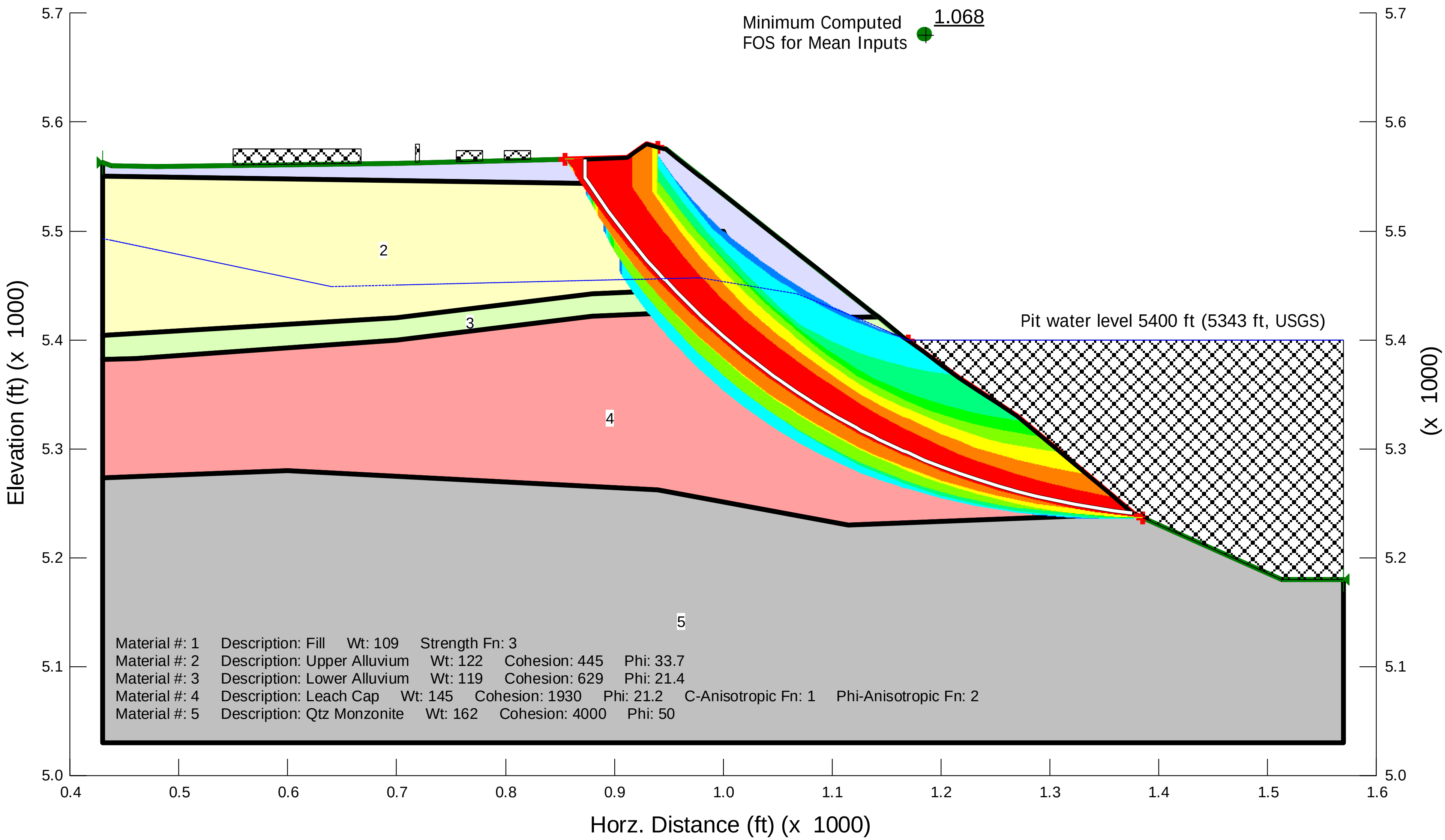
Scale as Shown, Anaconda Elev. Datum

March 2013 MI14010C Figure 1

Berkeley Pit: Updated Stability Analysis of Cross-Section 36300, Potential Rotational Failures, Pit Water Level 5400 ft

(Note deeper critical failure path through the Leach Cap)



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.03.

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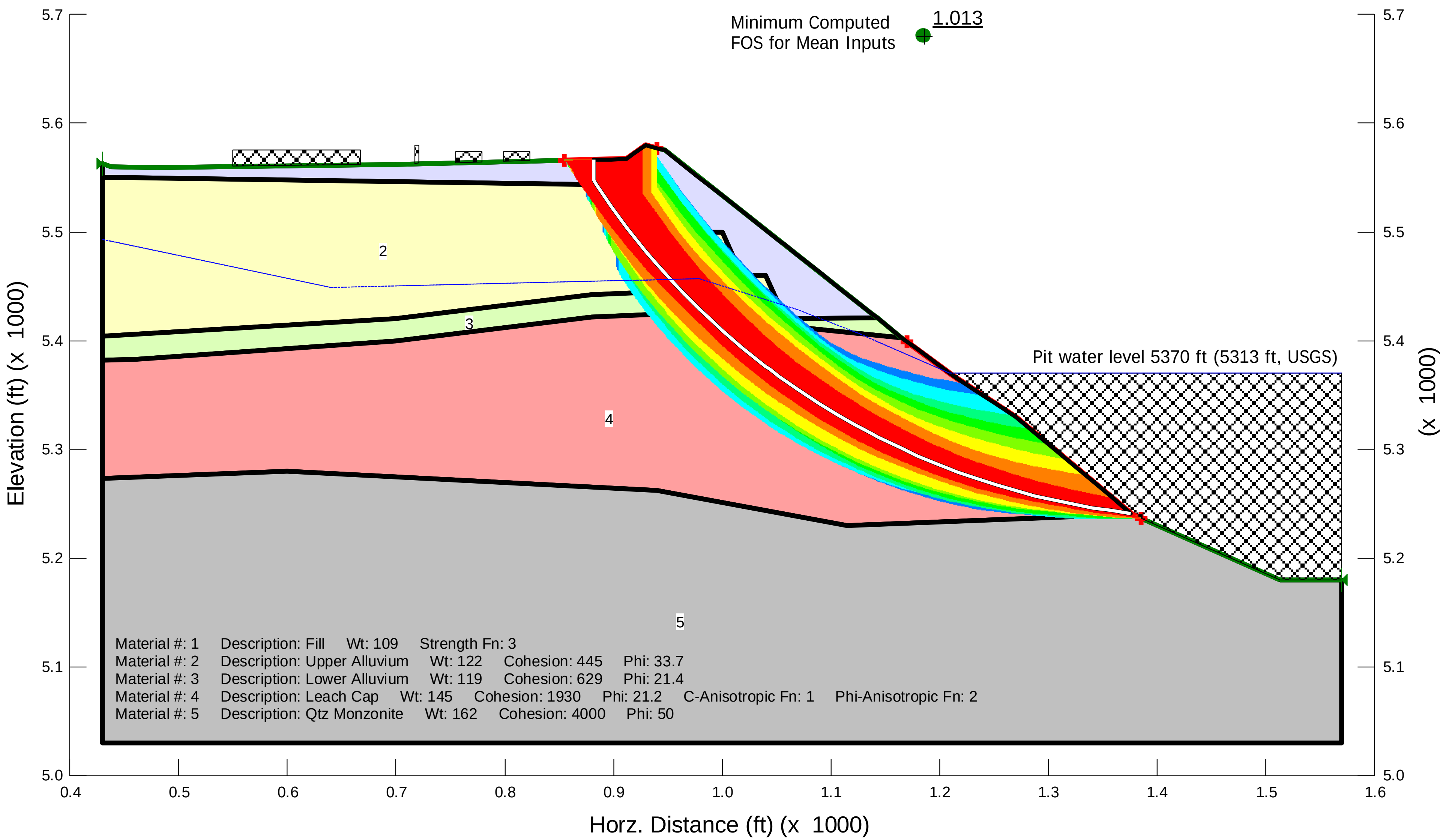
Scale as Shown, Anaconda Elev. Datum

May 2014 MI14010C Figure 2

Berkeley Pit: Updated Stability Analysis of Cross-Section 36300, Potential Rotational Failures, Pit Water Level 5370 ft

(Note deeper critical failure path through the Leach Cap)



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.03.

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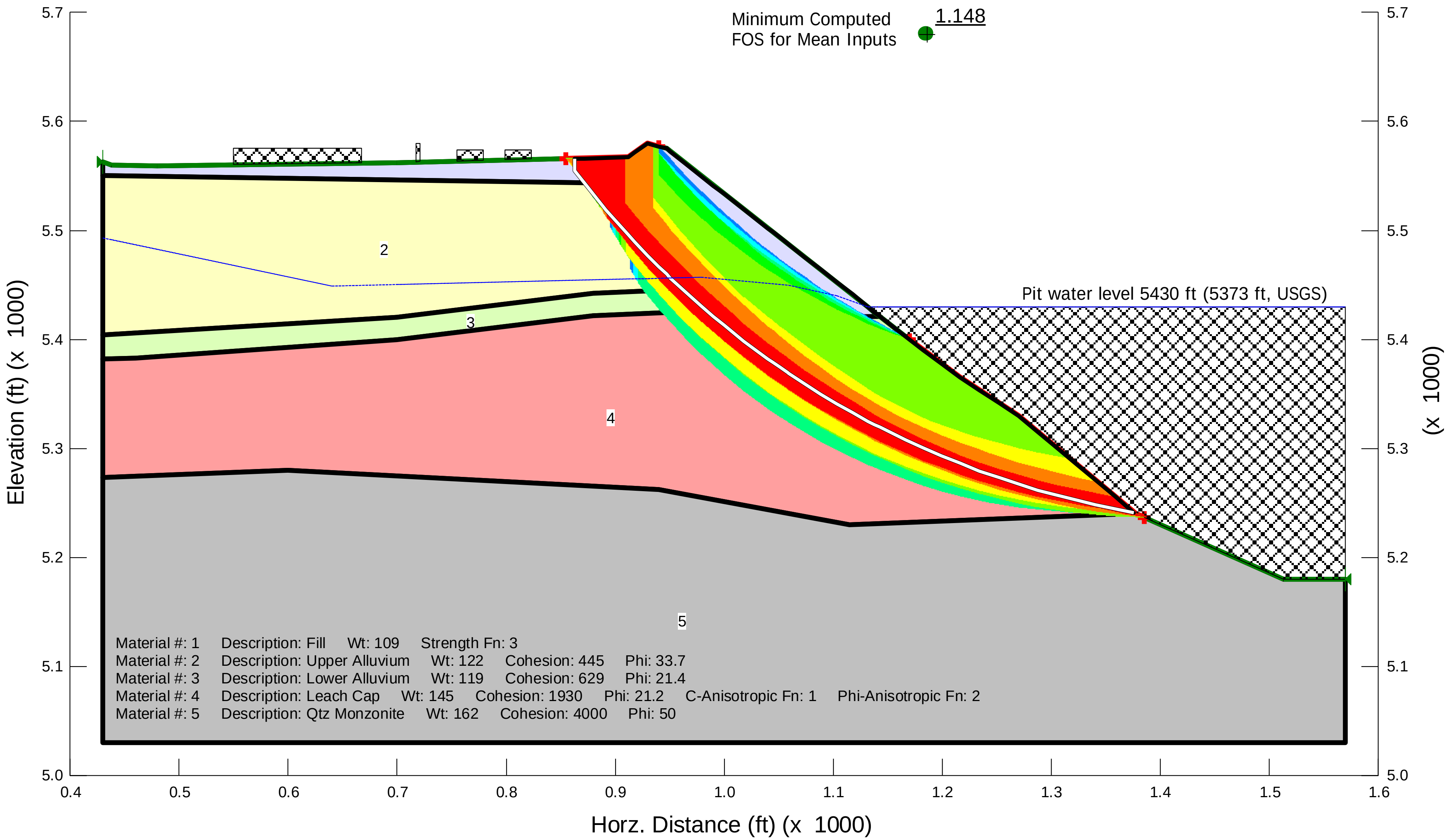
Scale as Shown, Anaconda Elev. Datum

May 2014 MI14010C Figure 3

Berkeley Pit: Updated Stability Analysis of Cross-Section 36300, Potential Rotational Failures, Pit Water Level 5430 ft

(Note deeper critical failure path through the Leach Cap)



Notes:

1. Subsurface geology based on estimated conditions using local geologic information.
2. Geotechnical properties based on experience with similar materials and laboratory testing; shear strength models for alluvium based on weighted mean regression of laboratory shear tests.
3. Morgenstern-Price method of slices. Computed factor of safety (FOS) colored contour interval is 0.03.

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Scale as Shown, Anaconda Elev. Datum May 2014 MI14010C Figure 4